CMHC
Canada Mortgage
and Housing Corporation

SCHL
Société canadienne
d'hypothèques et de logement

Canada

CMHC making
Canada a better
place to live

New Housing in Existing Neighbourhoods: Advisory Document

Aussi disponible sous le titre de *Logements neufs dans les quartiers existants — Conseils et recommendations.*

Price: $6.00

Canada Mortgage and Housing Corporation
Société canadienne d'hypothèques et de logement

Honourable Roméo LeBlanc
Minister

©Canada Mortgage and Housing Corporation, 1982

ISBN 0-660-11203-5
Cat. No. NH17-20/1962E

Printed in Canada

92-05905/

CONTENTS

Foreword v

Introduction: The Significance of Infill Housing 1

Part 1: The Development of Infill Housing 5

Where and When Has Infill Occurred? 5

Mature Neighbourhoods 5

Changed Market Demand 6

Renewed Interest in Mature Neighbourhoods 7

New Development Opportunities 8

Infill Development Opportunities 10

Street-related "Missing-Tooth" Site 12

Large Lots 14

School and Institutional Sites 16

Long Lots 18

Corner Sites 20

Unusual Conditions 22

Assessing the Feasibility of an Infill Project 24

Market 25

Tenure 26

Physical Configuration 27

Costs 28

Community Concerns 30

Neighbourhood Services 30

Part 2: Site-planning Considerations 33

Neighbourhood Context 35

Land Uses 36

Architectural Character 38

Scale and Impact 40

Neighbourhood Amenities 42

Street Frontage 44

Existing Buildings and Uses 46

Site Layout 48

Types of Site 49

Natural Features 54

Parking 56

Vehicle Access 58

Pedestrian Access 60

Communal Space 62

Building Separation 64

Project Identity 68

Setbacks 70

Project Detail 73

Private Outdoor Living Area 74

Unit Identity 76

Unit Entry 78

Unit Layout 80

List of Project Credits 83

Photo Credits 84

CMHC Advisory Publications 84

Foreword

Canada Mortgage and Housing Corporation (CMHC), the agency responsible for administering the National Housing Act, has established recommended standards for the site planning of housing in the document *Site Planning Criteria* (NHA 5214). These standards are generally of an advisory nature for the Corporation's insured lending functions, and mandatory for social housing programs. Proponents seeking National Housing Act assistance or benefits should consult the local CMHC office to confirm the status of their project.

The Corporation has also published a series of advisory documents whose purpose is to demonstrate the application of the recommended standards and generally promote sound planning and design*. The present publication is one of this series. It provides a background discussion of the factors influencing the development of infill, and design guidelines to help resolve typical planning and design problems. The design guidelines are based on good practice and are recommended to proponents of infill development; however, they are not a requirement of any CMHC program.

The preparation of this document has been directed by John Archer, Project Manager, Development Evaluation and Advisory Services Division, Canada Mortgage and Housing Corporation. The principal consultants were Barton Myers Associates Architects, and Planning Collaborative Incorporated, both of Toronto.

* A list of CMHC advisory publications appears at the end of this document (p. 84).

Introduction: The Significance of Infill Housing

The significance of infill housing can be described in several ways.

Infill is a renewal strategy. By adding population and amenity to a neighbourhood, and improving the use of existing services without adding to public costs, it serves a social purpose. It also influences a neighbourhood's environment by responding in its design or location to elements in the neighbourhood and contributing in turn to the neighbourhood's continuity, scale and character.

Infill is a new kind of housing. To compete with other forms of housing it must demonstrate its advantages over comparable dwellings. To meet this challenge, infill development has created innovative forms of low-rise, medium-density, often ground-related housing that offer enhanced liveability and increased individual identity.

Infill is a design and development process. Because the neighbourhood context already exists, the contrast between individuality and integration is heightened. The process must be one of "weighing the elements" or tradeoffs between important yet often conflicting requirements. Infill projects illustrate the principle of doing "more with less". The challenge in infill housing is to provide essential functional needs (typical of all housing), but often on less land or space than is customarily available for such needs.

The settled nature of mature neighbourhoods heightens the possibility of conflict with existing housing or services, and thus increases the complexity of the infill development process. This makes it particularly important that those undertaking or contemplating infill development should be sensitive to different points of view.

Infill Sensitive to its Context

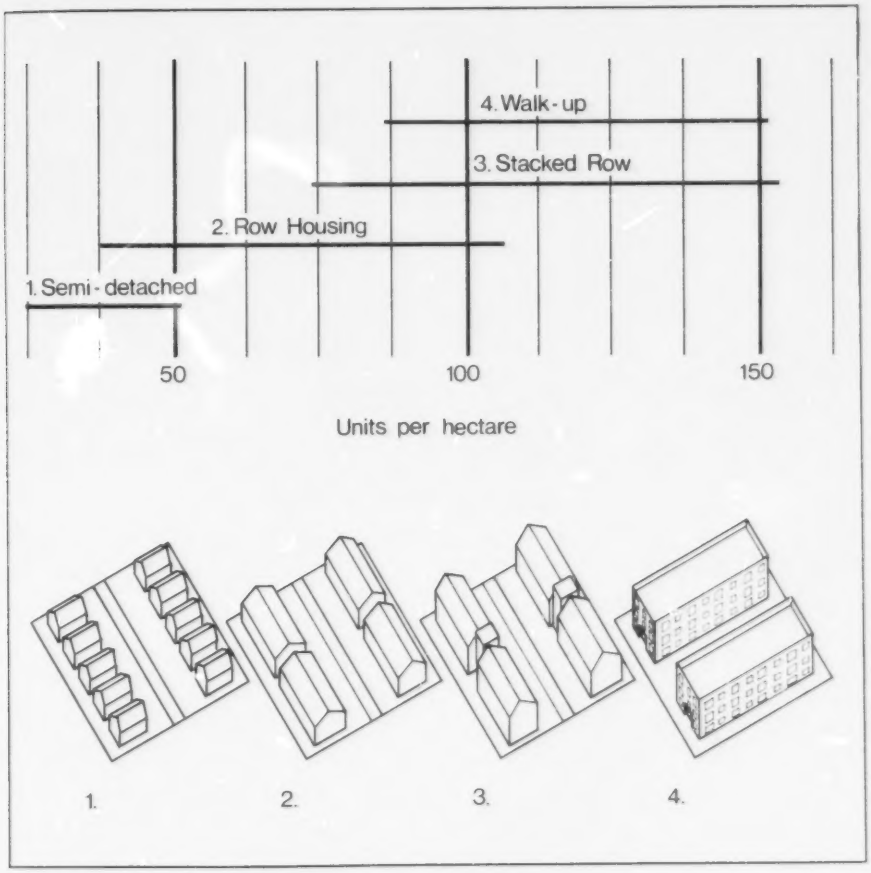
"Infill" refers to new housing development which adds to the stock of housing in mature residential neighbourhoods. "Sensitive infill" emphasizes that this form of development should respect the physical character of a neighbourhood and be compatible with its social, economic, historical and cultural context (see figure 1).

Although the term "infill" has been used to describe developments as large as a city block and 100 units or more in size, these are exceptions. This advisory document concentrates on small-scale infill projects, generally no more than 20 to 40 units in size, on sites under 0.5 hectares in area. Larger projects are no longer "infill", tending as they do to dominate their immediate residential surroundings or create an internal environment separate from the neighbourhood.

New infill housing occurs in a context of existing buildings, whether they are on the development site itself or nearby. Infill development may include the addition of new units to an existing house, new units in the side or rear yards of a large lot with an existing building, or new housing units on one lot relating to existing houses on nearby lots.

Mature neighbourhoods usually have low-rise detached and attached housing. Walk-up apartments are typical in cities such as Montreal and Vancouver. To be compatible with neighbourhood housing, infill projects are generally no more than three or four storeys high. The range of infill housing densities is from 25 to 150 units per hectare, or a floor area ratio (built floor area to site area) of 0.6 to 1.5 (see figure 2). Detached, attached, and stacked low-rise housing forms are common.

1. This low-rise infill housing in Vancouver is compatible with its surroundings — a good example of a sensitive approach to the planning of infill development.



2. Density ranges for infill housing.

Infill housing makes use of sites not already developed for housing by converting obsolete buildings or land uses to housing, or vacant land to built-up land; it can also add to housing sites that are under-used in their present form. In all cases, an intensification of use, of population, and of building is involved.

Infill housing can also be viewed as a process of urban renewal. The conversion of obsolete industrial or commercial structures to housing may be seen as recycling or conversion. This process adds new housing units, but not new buildings.

Upgrading the physical quality of existing housing, without new construction, is achieved by renovation and rehabilitation. This process may increase or decrease the number of housing units. Renovation and rehabilitation of some existing housing may also be part of an infill project.

Infill housing may be part of redevelopment when existing structures are demolished in an area one or more blocks in extent. But infill housing more often holds demolition to a minimum, and usually occurs in parts of blocks where many buildings still stand.

Sensitive infill housing reinforces neighbourhood continuity by respecting existing patterns of residential land use and house forms, while renewing the neighbourhood by the addition of new housing units in appropriate amounts and locations.

Part 1:

The Development of Infill Housing

Where and When Has Infill Occurred?

3. This traditional late nineteenth-century row housing is typical of older neighbourhoods in Toronto.

Mature Neighbourhoods

Many of the established neighbourhoods in Canadian cities were developed in the first part of the twentieth century, before the Second World War. Typically, these neighbourhoods developed as a first "ring" or "tier" surrounding the downtown area and were linked to its services and amenities. Municipal offices, employment, shopping, and cultural activities were bound together by a network of bus or streetcar routes. Local services such as public transit, churches, schools, parks, community activities and shopping also developed over time. In most of these "mature ring" areas, street trees and vegetation have had time to develop and mature.

The existing housing stock of such neighbourhoods is a direct reflection of the market conditions and building traditions of their era and the city at that time. In Montreal, the walk-up triplex is typical, attached to its neighbours, sometimes with a cut stone façade, always with an ornate cast-iron staircase from the ground to the second floor. In Toronto, it is the brick bay-fronted Victorian row house, usually semi-detached, like the one in figure 3. In Western Canadian cities, and in the Maritimes, traditional houses may be one-storey and two-storey wood frame houses with wood siding or stucco, or both.

Historically, infill housing has gone along hand-in-hand with the development of these neighbourhoods as an intensification of earlier low-density development patterns. Some characteristic patterns of this pre-war and post-war infill housing are small 4-plexes, 6-plexes, and 8-plexes in Calgary, walk-up garden apartments in Vancouver, and semi-detached and duplex houses in Toronto.

Infill housing built in the last decade often represents a second wave of redevelopment in these same neighbourhoods (see figure 4 for an example of a recent infill house) and is the result of several converging trends.

Changed Market Demand

Post-World War II housing development in Canada was dominated by the building of large tracts of low-density detached housing in outlying suburbs for young and middle-aged families with children. Two factors encouraged this form of development. The first was the low-energy cost of using private automobiles, together with the large-scale public subsidy of road building. The second was the belief that the suburbs were the best place to raise children. The population for which this housing was built has matured and changed, resulting in a diversity of household types: "empty nesters," elderly singles and couples, single-parent families, students, and young professional couples. The low-density detached housing in outlying suburbs may now be inappropriate in location, size, type or cost for many of these groups. Many of them are turning to the housing stock of older neighbourhoods.

4. These new infill townhouses on Balmy Avenue in Toronto combine the efficiency and convenience of new housing with the advantages of an older and established neighbourhood. The peaked roofs and neo-Georgian windows echo the character of older houses.

Renewed Interest in Mature Neighbourhoods

The qualities of mature neighbourhoods have only recently been perceived as attractive by many of the post-war population groups. Their location is a prime attraction. They are close to downtown services, employment, shopping and entertainment. Their character has fully matured and they offer attractive and distinctive housing stock, tree-lined streets and parks.

Mature neighbourhoods have all their services in place: established neighbourhood schools, social services, health care and public transit. They often offer other amenities, such as waterfronts, views, rivers, and ravines.

The lifestyle of the mature neighbourhood is also a drawing card. Community, social, recreational and "street" life is usually active and is not dependent on the automobile.

This interest in mature neighbourhoods has resulted in strong resale housing markets, and significant renewal and redevelopment activity in many communities. In response to the rapid changes taking place, the residents have often organized to preserve what they regard as the essential qualities of their neighbourhood life. This activity reached its height in the strong neighbourhood political movements in many Canadian cities in the late 1960s and 1970s, and often resulted in new planning and zoning controls intended to protect a neighbourhood's character.

New Development Opportunities

Market demand has also led developers to recognize new opportunities and investment potential within existing neighbourhoods. These may be new sites just becoming available for housing (for example, land formerly zoned for commercial and other uses that are no longer needed because of population or economic changes) and under-used housing sites (for example, small houses on large lots, vacant lots, large homes and lots, and sites at the edges of neighbourhoods).

New infill development is taking place in an atmosphere of heightened awareness of neighbourhood qualities on the part of both consumers and residents. New housing in established neighbourhoods must now respond to a more discriminating market and more complex political and planning processes.

In general, infill housing has tended to develop in cities with relatively strong growth prospects and housing demand, or those large enough to have strong market differences and advantages between locations and neighbourhoods.

Infill housing has been less prevalent in smaller centres, largely because of generally low growth, less diverse housing markets and housing types, and shorter travel distances, all of which make the locational and lifestyle advantages of older neighbourhoods over suburbs less pronounced than in larger cities. In time these conditions may change, resulting in more infill development.

5. This courtyard development in Willow Arbour, Vancouver, illustrates the sophisticated planning of space to provide such amenities as private open areas and unimpeded views.

6. These attached townhouses in Owl House Lane, Toronto, are at a higher density than the older adjacent houses, but they retain traditional at-grade planning.

7. The essential nature of the original building is still retained in these walk-up apartments in Vancouver.

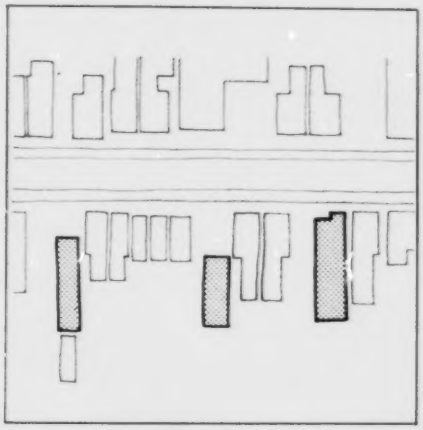
Infill projects that have developed in response to the conditions described above range from low-density conventional housing to complex and innovative higher-density projects in larger cities such as Vancouver. This housing is often characterized by the articulation and definition of individual units (with ground contact where possible) and site layout that increases densities and provides unit amenities such as private open space, views, and daylight in tight conditions. Figure 5 provides a good example of this.

Lower-density infill projects generally use conventional ground-related housing forms, such as attached townhouses, although often on sites smaller or narrower than usual (figure 6). Larger projects often transform conventional buildings, such as walk-up apartments, into highly articulated or terraced buildings, or apparent clusters of individual townhouses. The walk-up apartments shown in figure 7 are a good example. Some projects include the rehabilitation of existing houses on-site.

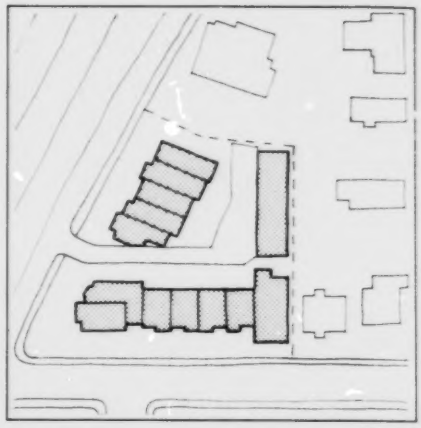
Neighbourhood planning controls in the larger cities have kept infill projects small and low in scale. Underground parking is often encouraged, and the new housing is built in a style and with materials that mirror the neighbourhood's architectural character. Zoning bylaws in smaller communities may not be as effective as they are in large cities in promoting infill development sensitive to the local context. This, obviously, may affect the desirability of allowing development to take place.

Infill Development Opportunities

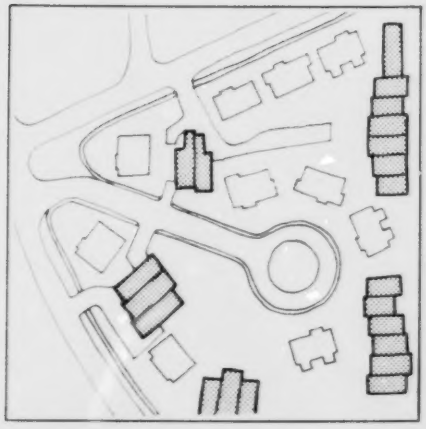
Infill development is strongly affected by local market conditions, which themselves are continually shifting. It is difficult, therefore, to generalize about all the types of sites that may be available and suitable for infill development. Nevertheless, there are types of site common to many Canadian neighbourhoods. These can be characterized by their location in a typical block, their size, shape, or other conditions. Figures 8 to 13 show the variety of types of site suitable for infill.



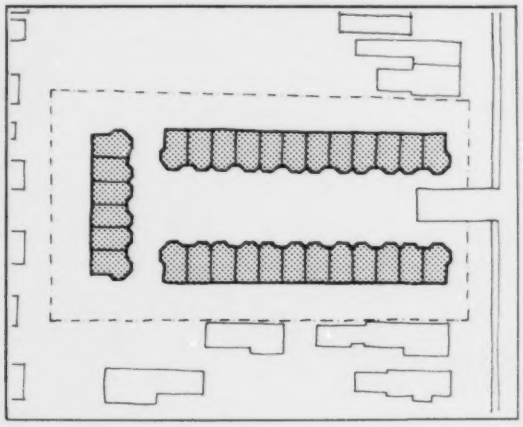
8. *Street-related "Missing Tooth" Sites* – single or multiple units on mid-block sites consisting of one or more side-by-side standard lots.



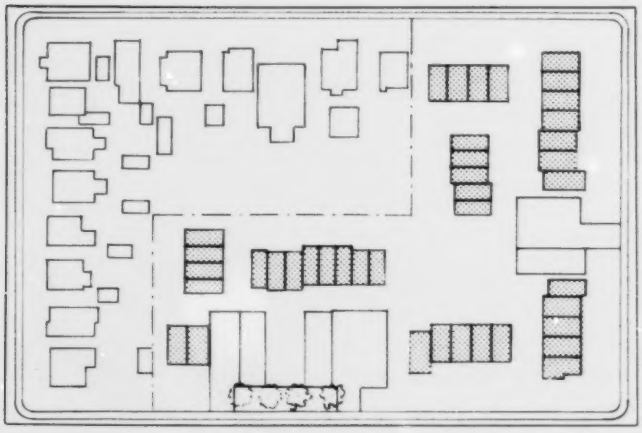
9. *Corner Sites* – sites at street intersections, both adjacent to, and on the edges of, residential neighbourhoods.



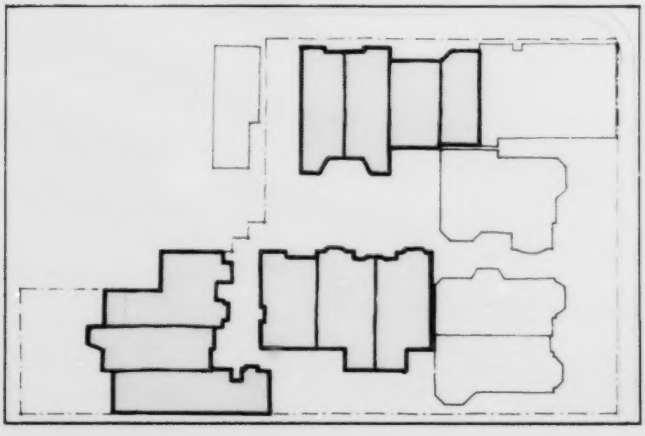
10. *Large Lots* – lots exceeding 900 m^2 or 1 000 m^2, often with existing substantial houses, in mature neighbourhoods.



11. *Long Lots* – lots longer than 36 metres which are often narrow in proportion.



12. *Institutional Sites* – large sites, often exceeding 0.5 hectares to 1.0 hectares, and usually including a substantial institutional building of some architectural distinction (a school or church), two to three storeys in height.



13. *Unusual Conditions* – sites of odd shapes and sizes whose configurations largely determine the kinds of infill development that are possible.

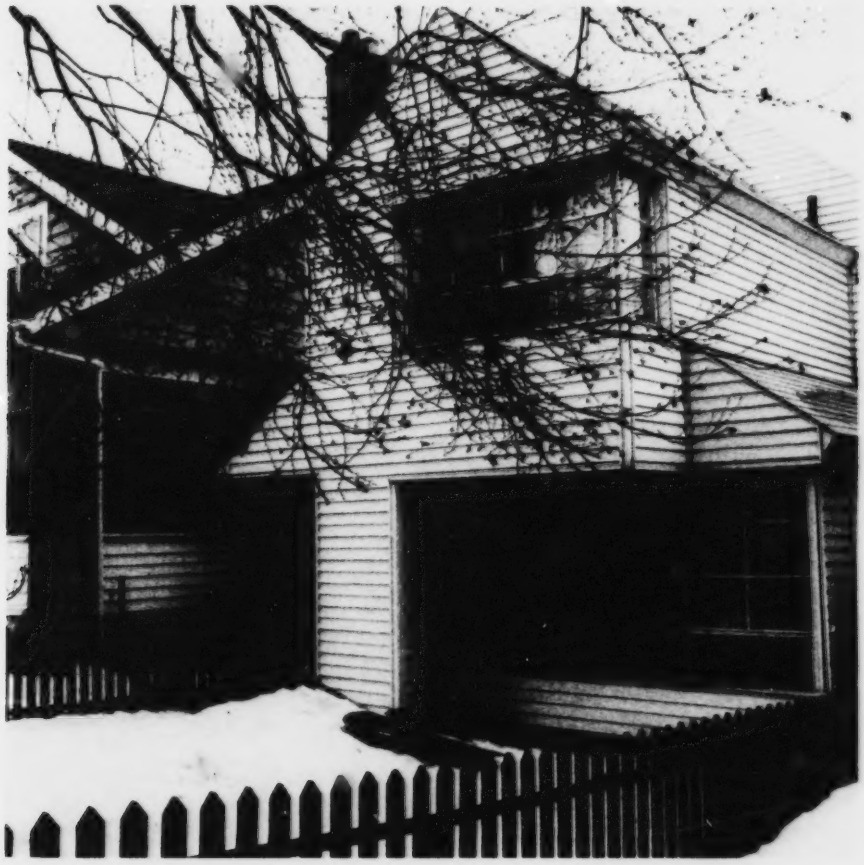
Street-related "Missing-Tooth" Sites

"Missing-tooth" sites are mid-block lots facing one principal street, occasionally with access from a rear lane. They may comprise a single standard lot or several such lots side by side. Mid-block sites are among the most common infill development opportunities. They often become available because a single dwelling on a lot has been demolished or destroyed by fire. Sometimes a large lot is severed into two parcels, one vacant and one retaining the existing dwelling. Abandonment or removal of an obsolete building also provides opportunities for infill housing. Figures 14 and 15 show a typical missing-tooth site and its completed infill house.

Missing-tooth sites have several advantages:

- purchase and development costs associated with small infill parcels are affordable to small local developers and entrepreneurs
- sites within a particular neighbourhood are likely to be already zoned for residential use
- sites are already serviced, and within walking distance of established neighbourhood amenities and shops
- sites are suitable for conventional ground-related housing forms (detached, semi-detached, townhouses) which are familiar to a neighbourhood, and generally easy to sell or rent.

14, 15. The plan shows the viewpoint from which the infill Toronto house in figure 15 was photographed. The new house on the right has the character and size that allow it to fill attractively the missing-tooth site it occupies mid-block.



15.

Certain development problems may be encountered with ground-related housing on mid-block sites. One is that the narrow street frontages of some sites may be unable to accommodate a front entry, garage, front lawn, porches and so on. In such cases, tradeoffs which respect neighbourhood character will be necessary. There is also a practical minimum width to ground-related units (in the range of 4.1 m to 4.5 m) which should be considered, as well as the width pattern of existing houses on the street (see figure 16).

Another point to consider is that mid-block sites are generally small parts of an established streetscape. The patterns of nearby housing — unit access, garages, building heights and widths, lot sizes, setbacks, architectural character and so on — will, therefore, be important determinants of new infill units.

Finally, small lots often have few site layout options. This lack of flexibility may result in increased construction costs and so affect the project's economic feasibility.

16. The tall narrow townhouse on the right manages to squeeze into its minimum-width site, but in so doing, the interior planning of the dwelling may have suffered. The practical minimum width of a house must be considered when evaluating sites for infill development.

Large Lots

Large lots (more than 900-1000 m^2 in area) are often found in older established neighbourhoods in the form of large "estate" houses, with correspondingly oversized and underused side, rear or front yards. Frequently these estate houses have historical or architectural significance in the community.

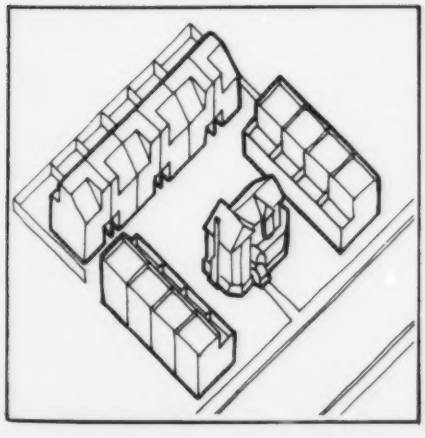
The prospect of new infill development on such sites may be controversial to neighbourhood residents. New infill development may, however, be one of the few options open for the economic renewal of the properties. This factor, together with the demonstration that the new housing is sensitively planned, will be critical to the acceptance of a project by the community.

The planning of these large-lot sites generally takes the following forms:

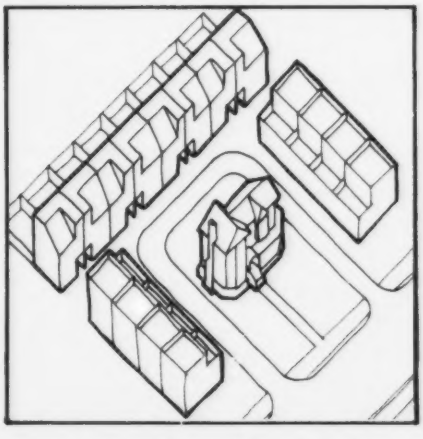
- development of new housing in a cluster or courtyard around an existing house, itself renovated to provide several units
- extension of the existing house by new attached wings, to give the appearance of additions to the original structure
- new housing in side or rear yards, in the traditional relationships that gatehouses or stable buildings bore to the original house (see figures 17 and 18).

17, 18 A mansion on a large lot was turned into a nest of townhouses by making additions on either side. This project, in a well-established neighbourhood on Echo Drive and Rosedale Avenue in Ottawa made up almost entirely of single-family homes, introduces an entirely different kind of housing in a manner that is both unobtrusive and attractive.

18.



19. If historic buildings are present on an infill site, they may be retained as a focal point. Sometimes occupants may find that they lack privacy.



20. On sites with historic buildings, new dwellings must still have a street presence, but, unless carefully planned, vehicle-access roads may compromise outdoor amenity areas.

Development issues with large-lot sites are more complex than with mid-block sites. For example, existing buildings have an important functional role in new infill development, whether rehabilitated for communal activities, offices or shops, or for housing. If an existing building is developed as a focal point in a project, it may be difficult to retain its previous prominence while at the same time preserving the privacy necessary for housing (see figure 19). A sympathetic relationship of form and architectural character in the new and existing houses will be essential.

Problems of identity and access also arise. New units developed in a courtyard or cluster around an existing house must be given a "street presence" or identity of their own. Access for vehicles to the interior of the site, which will necessitate driveways or internal roads, should be laid out without compromising the setting of existing buildings (see figure 20).

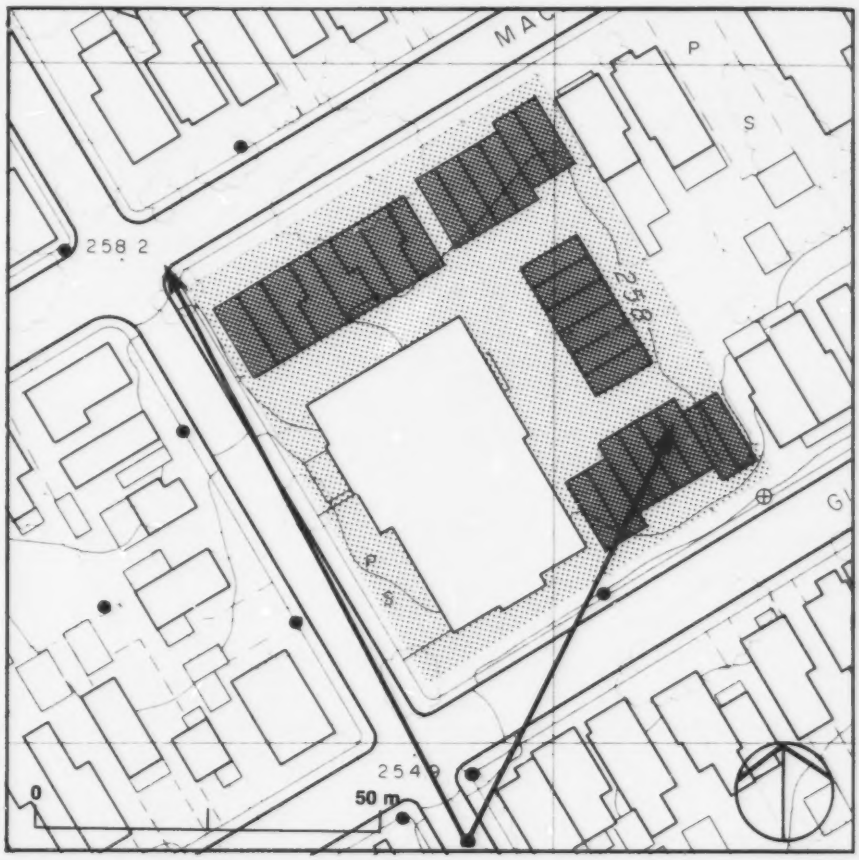
School and Institutional Sites

Inner-city schools, churches, and other institutions frequently suffer from low enrolment and a declining population base. Once they are no longer required, their sites become prime opportunities for redevelopment. These sites are usually large (often 0.5 ha or more in area), relatively flat, and suitable for comprehensive planning. Often there is an existing building adaptable to housing or other uses.

Institutional sites are often located in the heart of a residential neighbourhood, on collector or arterial roads, close to transit and commercial and social services. In addition, access and servicing for a large site is often possible from two or three sides, offering site-planning flexibility. Figures 21 and 22 show the successful conversion of a school site to an infill project of 42 stacked townhouses.

Infill development issues focus on the impact the development of these institutional sites may have on the neighbourhood. A large number of new housing units can generate significant traffic volume and noise, and the influx of large numbers of one specific social or economic group may affect a neighbourhood's stability.

Large open spaces (such as a schoolyard) that become the site of infill projects may mean the loss of an important neighbourhood recreational or visual amenity.



21, 22. This infill project in Ottawa converts an institutional site to housing. The shell of the old Percy Street school, damaged by fire, is now used for covered parking. An outdoor community recreation deck has been built over the parking area.

Loss of the site may also mean the loss of social services provided by the institution, for example, day care, evening classes, and recreational programs. The new housing generated by the infill project may also put a strain on existing neighbourhood services. Some services, such as transit, are readily adaptable to new population loads. Others — schools, for example — may have trouble absorbing both the students transferred from the closed school and students drawn from the new resident population. New family housing projects may not be appropriate where remaining schools are either far away or are already full.

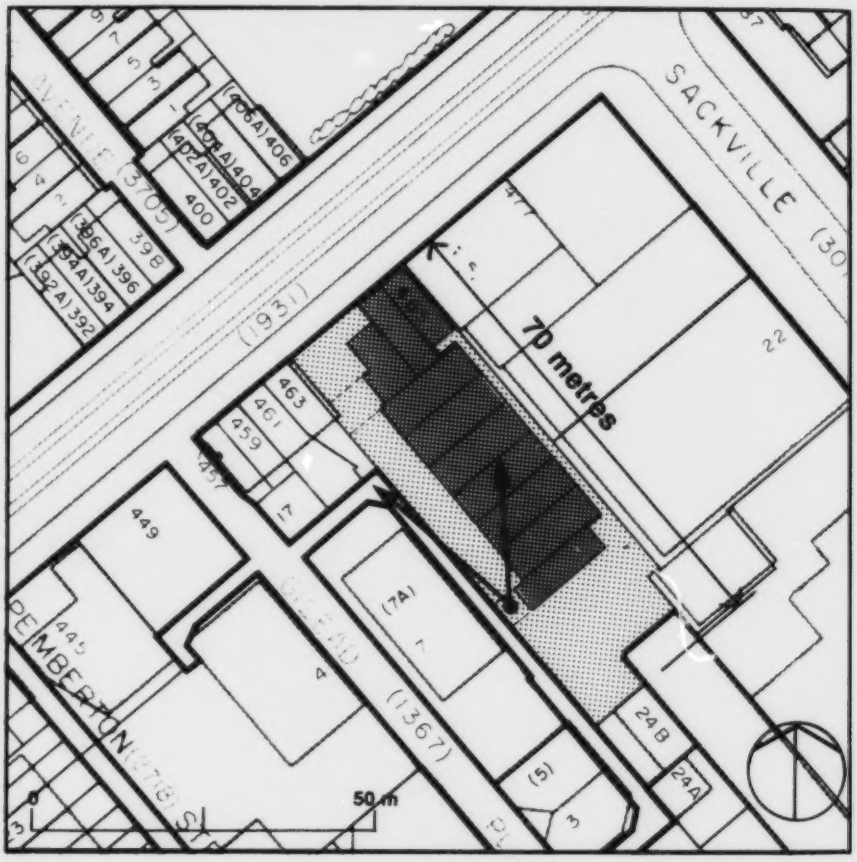
22.

Long Lots

Many older neighbourhoods were laid out on a regular basis, with standard rectangular lots whose dimensions (for example, 10 × 30 m to 15 × 36 m) were usually whole or partial multiples of the surveyor's 66-foot chain. However, topographical conditions, existing streets and buildings, or historical accidents also resulted in blocks with lots shorter or longer than average. This "average" depth varies from city to city, but the long lots considered here are generally more than 36 m in length.

Long lots are often underused. The houses on them face the street, leaving long rear yards that usually are too large to be used effectively. Sometimes these rear portions are severed and used as parking lots, auto wrecking yards and other backyard enterprises that may be neighbourhood eyesores.

The essential characteristics of long lots (great depth combined with limited street frontage) generally means that some housing will have to be located in the rear of the site without direct street frontage. This will usually eliminate freehold ownership of the new development. Access to the interior of the site will need to be provided from the street unless a suitable rear lane is present. Figures 23 and 24 show the uses to which one long lot has been converted.



23, 24. Vehicles approach this Toronto infill project (Trinity Mews) by a side driveway. This is a mixed-use project, containing shops and businesses as well as townhouses.

24.

25, 26. These infill units are perpendicular to the street, with a side driveway. Parking is partially below grade, under a deck that provides pedestrian access to each townhouse.

26.

If a long lot has narrow frontage (figures 25 and 26), infill development tends to be placed perpendicular to the street. Such a layout means that the continuity of the streetscape is broken by side yards and open spaces. A major access driveway will have to be placed along the length of the site with the result that some housing units will be far from the street and difficult to locate. In this kind of infill project, the orientation of houses and open spaces will be different from the rest of the block.

Even if the lot width permits some units to be placed along the street frontage, thus maintaining the streetscape, units at the rear of the site (houses behind houses) will not have exposure or addresses on the street unless a major opening is introduced.

Other things to remember in site planning for long lots is that they will require emergency vehicle access to the rear of the site, unless rear lane access is available. Privacy also becomes an issue. Units at the rear of a long lot may overlook or block sunlight to the open spaces of adjacent housing. This will be a matter of concern to the neighbours of a potential infill project.

Corner Sites

By definition, corner sites have two street frontages, a condition that can often be used to advantage in infill development. Two types of sites are common, the first being the site at the intersection of two minor residential streets. Often these sites are larger than the mid-block sites found in the area. Figures 27 and 28 show an infill development on such a site.

Corner sites attract development interest for several reasons. They permit housing with distinct aspects and addresses on two different streets. Freehold tenure is often possible. The problems of "houses behind houses" on long lots with narrow street frontage can generally be avoided on a corner site.

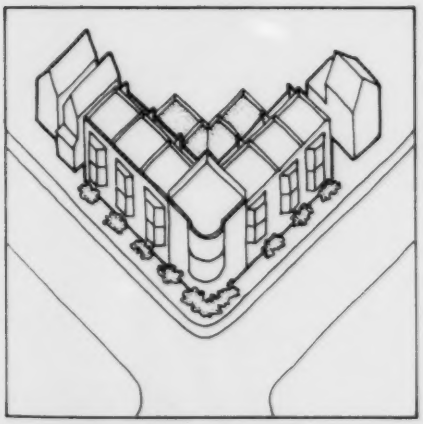
Corner sites do not usually require emergency vehicle access or driveways into the site. They are also likely to be close to and well served by neighbourhood amenities and transit.

The second common corner site is found at the intersection of a major (often commercial) street and a minor residential street. These sites may become available because of the declining interest in their use for such things as gas stations or small commercial plazas. While subject to more traffic and noise than mid-block sites, corner locations may be better served by public transit, nearby shopping, and other services.

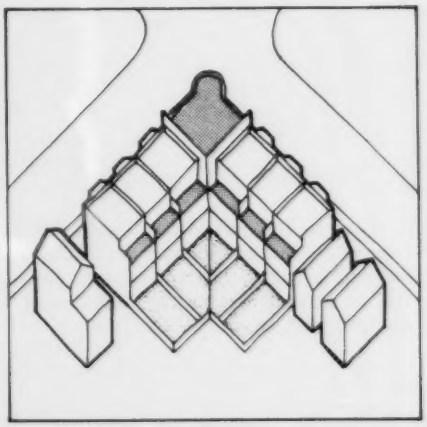
Planning regulations often permit higher densities along major street frontages. In mixed-use development, commercial units may be able to front on the major street, while residential units front on the quiet side street.

27, 28. This Vancouver ten-unit townhouse project is at the intersection of two minor residential streets. The corner dwelling has been provided with a roof-top deck for outdoor living.

28.



29. The corner unit has greatest prominence and should be given strong architectural character.



30. This corner unit has no rear elevation. Roof decks provide outdoor living areas.

While corner sites are attractive as infill sites, they can also raise complex development issues. Although it is generally possible to front housing along two streets, physical access for vehicles may be restricted on either frontage, particularly close to the corner, and so cars may not have direct access to every unit.

New infill development that does not front on both streets will introduce a blank face on the "neglected" street. This could be particularly detrimental for a commercial street.

Exposure on two sides means that corner buildings have a greater impact on the character of city streets than mid-block buildings. The neighbourhood context may require that the corner be given architectural emphasis or prominence (see figure 29).

Privacy and open space in a corner unit may be hard to achieve because of its exposed location and lack of private "back" elevation. See figure 30 for possible solutions.

Major street frontages usually mean heavy pedestrian and vehicular traffic, and so corner lots are often noisy and lack privacy.

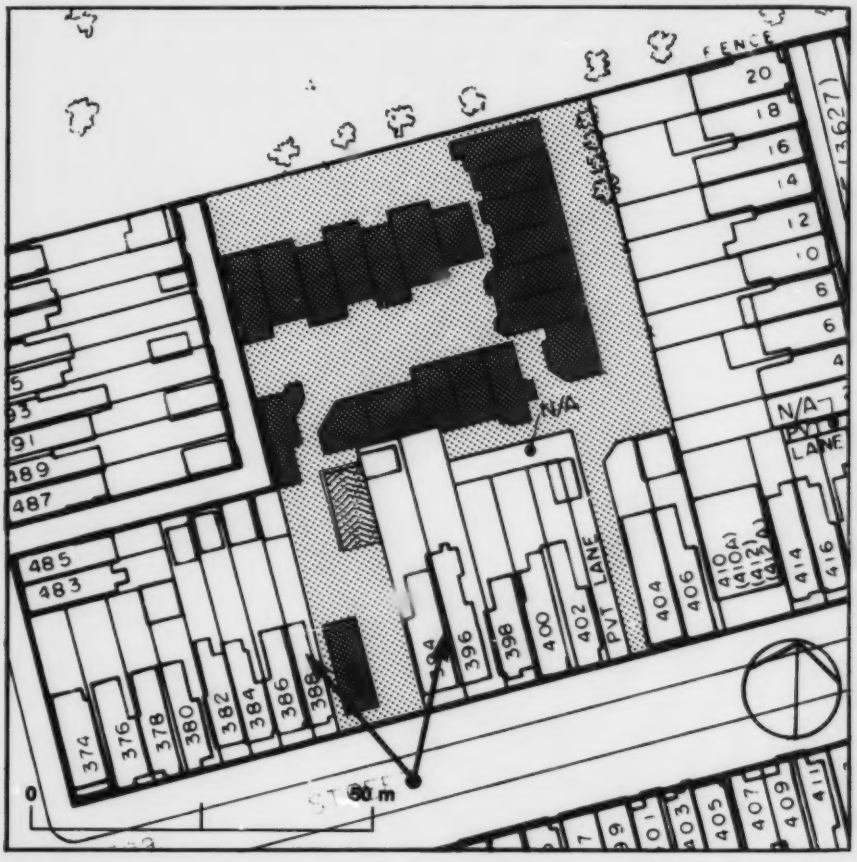
Unusual Conditions

While the site types already described are the most typical encountered in Canadian cities, this does not preclude the possibility of infill development on "unusual" lots. Most urban sites with street access can be developed unless they have very little street frontage relative to site area.

The range of unusual conditions that may be encountered is not limited to narrow frontages or poor access. Sites may also be of irregular shape or on steep slopes. There may be unattractive land uses nearby or existing buildings of architectural or historical interest that must be accommodated in any infill plan.

Unusual sites may be the product of land assemblies, road realignments, obsolete land uses, historical "accidents," or similar conditions. Their irregularities may have made existing uses uneconomical (particularly commercial uses requiring easy access and traffic flow, and room for expansion). Lack of street exposure may also mean that these sites will not be of major importance to a neighbourhood for public uses such as parks.

Sites with unusual conditions are often overlooked for housing, because they lack frontage or exposure, and design and planning problems appear difficult to resolve. These can often be improved by additional land purchases or land trades with nearby owners to improve the site configuration.



31, 32. Owl House Lane, a 21-unit infill project in Toronto, shows how a lot with practically no frontage can still be used successfully as an infill site. Only one of the units has its own street frontage.

32.

Even though site conditions will differ, there are several standard planning considerations to bear in mind. One is the bottleneck site. Street presence for housing units is difficult to achieve with this kind of site. Many, if not all, of the new units may be remote from the street. It will be necessary to gain access to them by gateways, walkways or driveways. Emergency vehicle access may be a major determinant of site layout. Figures 31 and 32 show the layout of a lot with severe frontage restrictions. What access there is may have to be shared by many units so that communal forms of tenure will probably be necessary.

Site configuration will largely determine the shape of the housing project site and site planning responses, particularly to ensure privacy. With difficult sites, a preliminary assessment, including trial layouts, may be necessary to determine whether or not the site can be developed successfully.

Because unusual sites often lack street frontage, infill projects may need to create a focal point within the project to unite the off-street housing units.

Assessing the Feasibility of an Infill Project

Because infill housing is often a more complex form of development than other types of housing, a feasibility study should be carried out before detailed site planning is undertaken. This analysis will be of greatest interest to the project developer or proponent, but other groups — local residents and municipal officials, for example — will also want to assess the project from their particular perspectives.

A feasibility study should cover the following steps.

Identification of an Infill Development Opportunity

For both private and public sector developers, site selection should be based to a large degree on favourable community and neighbourhood characteristics, unfilled housing demand and site characteristics (size, type, cost, physical conditions, and surrounding uses).

Development of the Concept

The nature of the project must be fully worked out — unit mix, size, and tenure. Similarly, the physical potential of the site must be fully understood in order to comply with or take advantage of municipal regulations and to enable a general schematic plan to be drawn up.

Assessment of Impact

Questions on three issues should be answered in assessing infill development concepts:

- financial: what revenue will rents or sales generate? What will construction and development costs be? And what financing will be required?
- neighbourhood services: what impact will the project and new residents have on neighbourhood services?
- community concerns: will the project be acceptable to local politicians and residents?

Refinement of the Analysis

Feasibility analysis is likely to involve several repetitions of the above steps, in a continuing series of modifications during which the critical factors are assessed and refined to make the project more acceptable to all concerned. The factors that will require careful scrutiny are: the market, tenure, the physical configuration of proposed buildings, costs, neighbourhood services, and community concerns.

Market

Under current conditions, infill projects developed for sale or rental in the open market tend to attract professional two-income couples and households with few children. This market will have specific requirements (1-2 parking spaces for each unit, for example) but it will make few demands on such things as the local school system.

Marketable housing projects tend to be located in more affluent neighbourhoods that have environmental amenities, active real estate markets, and high land prices. New housing must be competitive with existing housing in price and quality; therefore, units are often large (2 or 3 bedroom, 150-200 m^2) with well-landscaped grounds and attractive outdoor areas (usually smaller than those found in existing housing). Some sales price premium (up to 15 per cent) can be expected for new construction and added features.

Under certain density regulations, smaller unit-floor areas may permit more units to be developed on a site; this is often resisted by developers, however, because smaller units appeal to a narrower market segment and may take longer to sell or rent. Ownership forms of tenure, such as freehold and condominium, are generally more attractive to developers since they command premiums over rental. In fact, rental projects may not be feasible at all. The high cost of new construction and financing requires high rental rates. Usually the existing housing stock around the site will rent at much lower prices, making the infill rents uncompetitive.

"Assisted" infill projects financed by government social-housing programs and developed by non-profit cooperative groups and public agencies are intended for groups that cannot compete in the for-sale or rental markets.

Because of land-cost guidelines in government-assistance programs, assisted projects are often located in different neighbourhoods from prime-market housing — outlying areas with lower land prices or sites owned by public agencies, surplus to their requirements. The high costs of infill sites in central neighbourhoods may require relatively high densities for assisted projects to remain within the land cost/unit guidelines. While sites with lower land prices do exist in central neighbourhoods, these often have accompanying difficult site conditions such as irregular shape, traffic or railway noise, or adjacent industry.

The clients served by government-assisted projects (single-parent families with children, for example) will make heavy demands on some services (day care and schools) but less demand on others (parking). In particular, families with children will require large private outdoor living areas near grade level and communal play spaces, both of which are difficult to achieve at higher densities. These requirements are generally quite different from those of open-market housing in mature neighbourhoods.

Tenure

All forms of housing tenure are possible in infill projects:

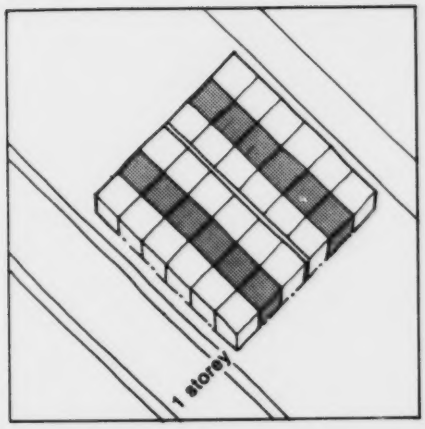
- freehold – ownership of home and lot
- condominium – ownership of dwelling units, with joint ownership and responsibilities in common facilities and the project site
- cooperative – ownership of shares in a group or association which owns a housing project, the shares authorizing individual occupancy of a particular unit
- rental – payment of a monthly "fee" secures occupancy of a dwelling unit in a project owned by others.

For development purposes, freehold is a particularly desirable form of tenure because of its marketability. Generally, it is preferred over other tenure forms. It is especially suited to mid-block and corner infill sites. Corner sites are attractive because they have two or more street frontages from which access to individual dwellings can be provided. Where access from a street is limited, driveway easements to a limited number of lots may still be feasible. Figure 33 shows a corner lot infill project with easements.

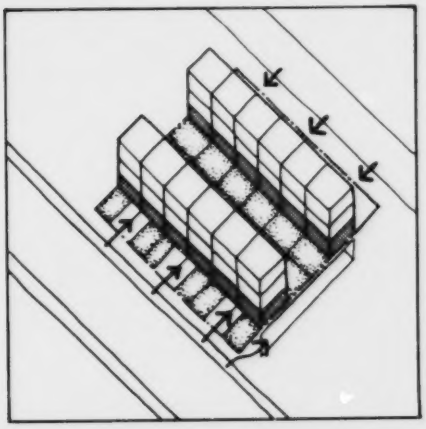
The other forms of tenure are necessary if something is shared in common (such as an underground parking garage) or if some units do not have street frontage. Communal forms of tenure are usually necessary with long sites and unusual sites.

33. The units and lots in this project are owned freehold. A shared driveway that gives access to individual garages is provided through easements.

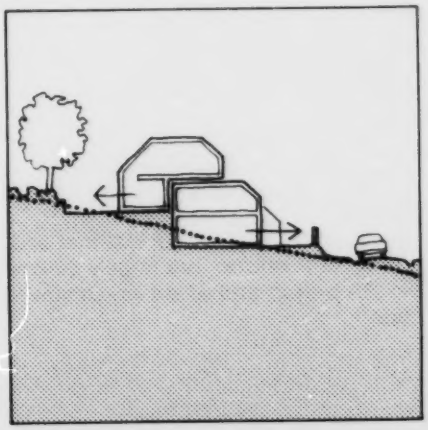
As densities increase (above a floor-area-ratio of 1.0) and units must be stacked, other tenure forms with or without freehold become necessary. For example, the traditional Montreal triplex is a combined freehold and rental unit, owner-occupied at ground level with two rental units above. Apart from this specific example, however, a mix of tenures is probably undesirable since responsibility for shared areas can be a source of conflict.



34. This one-storey building covers an entire lot. It has a density of 1.0 FAR.



35. These three-storey townhouses are also at 1.0 FAR. They will require underground parking unless a rear lane provides access.



36. Sloping sites like this one may permit more frequent grade access at a given density.

Physical Configuration

Physical variables are interrelated in their effects. The most important is density, often expressed as floor-area-ratio (FAR); this is the ratio of the built floor area above grade to the site area. In existing neighbourhoods, single-family housing is typically built at an FAR of 0.3 to 0.6, townhouses and duplexes at 0.75 to 1.0, and walk-up apartments at 1.0 to 1.5.

An FAR of 1.0 is critical in many respects. Above this density, it becomes difficult to provide all units with access and private outdoor space at or near grade level. It is also the density at which surface parking becomes impractical and garages or underground parking facilities are necessary. Figures 34 and 35 show two different kinds of projects in which an FAR of 1.0 might occur.

An FAR of 1.5 is also critical because it is at approximately this density that the three-storey height limit for wood-frame construction is exceeded. Above three storeys, more expensive non-combustible construction and fire separations for walls and floors are required. Some layering of functions, such as roof-top decks and underground garages, may be necessary to maintain a low-rise scale.

Several other factors may modify these density limits. Lane access can prove useful (if available) because street frontage need not be allocated to driveways and garages. Land slope may permit a "layering" of grade access, permitting more grade-access units to be provided at a higher density than might otherwise be feasible (see figure 36).

Municipal zoning regulations will usually determine the density to which a site may be developed, and are a major determinant of land costs. Infill developers often look for sites that permit densities higher than those prevalent within a neighbourhood. Examples are:

- sites on the edges of residential areas with higher commercial or mixed-use densities
- walk-up apartment zones in which new infill housing with improved amenities can be developed at existing densities
- zones in which existing housing is built at densities under those allowed by municipal regulations
- development-permit or review zones in which density bonuses are given for improved housing quality.

Where municipal regulations permit some variation in density (as they do in certain zoning districts in Vancouver), the infill developer may have to carry out a design analysis to prove that the project meets the community guidelines for density increases.

Where municipal regulations are not flexible, the developer must decide whether to accept these limits or not; he may have a valid basis to apply for special consideration to permit density increases. However, the project may thereby be exposed to delay or further changes, which could substantially affect its feasibility.

Costs

The major costs associated with a development are: land acquisition; construction; site development, including service connections; interim financing; "soft" costs, such as legal, promotional and professional fees.

In addition, because infill projects are "one-off" in design and construction, development costs are higher than those for suburban tract housing, where economies of scale are possible. Restricted site access may also increase costs.

The return on investment which a developer can expect is based on the number of dwelling units the site can accommodate multiplied by the sales price (or capitalized rent) of each unit. If the basic equation of return minus costs is negative, then the developer must either increase the selling price (or rents) or reduce development costs.

Opportunities to reduce costs may be limited. One possibility is to reduce the number of underground parking spaces normally required. This may be sensible in central areas with good transit or in projects planned for elderly occupants. Substantial savings can be achieved this way.

Another possibility is restricting construction to three storeys or less. Economical wood-frame construction can then be used. Other development costs, such as prices of material and terms of financing, are largely external to the project and affect all construction.

There are major differences between the returns from market housing and those from assisted infill housing. Market housing is generally feasible only where consumers are willing to pay for the advantages of location, neighbourhood amenities, and urban life-style. In communities with the right attributes, land costs are therefore likely to be high. Returns can be improved through increased density (more units or larger units, resulting in more built floor area to sell) or through improving the dwelling's amenity or special features (resulting in an increased price for the same floor area).

The development of assisted housing is oriented towards affordable accommodation. Land costs per unit must be reasonable and limits are often fixed by government financing programs. The development of expensive central-area sites is only feasible if densities are high enough to bring land costs per unit below maximum limits, or if the sites are made available at below-market prices, or if the assisted housing is mixed with market housing or commercial uses (such as offices and shops) that can carry most of the land costs.

Without these advantages, developers must look for less expensive sites, usually in outlying areas without the locational advantages of central sites. Because social housing client groups cannot pay high rates for housing, developers do not have the option of increasing prices through improving amenities in each dwelling.

For both types of housing, once a site is selected, the infill feasibility analysis process is usually directed towards improving dwelling amenity without increasing costs and intensifying site development, yet still retaining neighbourhood compatibility and acceptance. To a municipality attempting to encourage neighbourhood renewal, a moderate increase in density and some relaxation of zoning regulations in return for improved housing quality may be an acceptable tradeoff.

To a public or private developer concerned with market risks, time is very important. Delays in planning approvals add to development costs and uncertainty; developers therefore attempt to avoid rezoning or variance hearings in order to avoid the risk of delay. However, special consideration is often needed in the development of infill housing sites. If a neighbourhood renewal process is to be encouraged through private infill development, political support is usually necessary to reduce the risks and delays normally associated with the process. Both the municipality and the developer can benefit from performance-rated municipal site-planning regulations. These reward housing quality with returns that make such projects financially attractive.

Community Concerns

New population and redevelopment can change the physical character of a neighbourhood and create unease in a community. A slow process of population change is understandable to most residents as households mature and houses change hands. On the other hand, if redevelopment occurs too rapidly, and introduces too many new residents, or causes existing services to become over extended it can be potentially disruptive to a neighbourhood and may be opposed by local residents.

An infill project may, therefore, have to allay the concerns of both local politicians and residents. Local politicians will have the following concerns:

- will new residents make use of the underutilized capacity of existing services without overtaxing them?
- will the project contribute to neighbourhood renewal without disrupting its character?
- will the project provide housing for groups who are under-housed in the community?
- will local entrepreneurs, suppliers, contractors, and tradesmen benefit from the new development?
- will the project reinforce the viability of existing shops and other services?

Local residents will have other concerns:

- will new residents with different lifestyles and income levels come to dominate the existing residents?
- will the project make housing available to local residents?
- will new residents bring demands for political change and additional services?
- will the project maintain the scale and character of housing in the neighbourhood?
- will the new development improve, or at least not worsen, environmental problems such as parking and traffic congestion?
- will the project be an improvement over previous use of the site?
- will the project demolish or make use of existing buildings of architectural character?

Neighbourhood Services

Infill housing may have an impact on the established services within a community. Table 1 shows what the impact might be on various services and the possible responses.

Table 1 Impact of Infill Project on Established Services

Established Services	Impact	Possible Response
"Hard" services: water, sewer, storm drainage, utilities	Review with city works and engineering departments; existing services likely to have unused capacity	Generally no impact
"Soft" services: fire, police protection	Population generates increased service calls; review with respective departments	Operations unchanged unless there are major population shifts; new manpower hired on a population basis
Education	Project yields additional school children; school capacities and standards available from Board of Education	Generally, central area schools will be underused but if overcrowding seems likely a change may be necessary in unit mix to reduce the number of children
Parks and recreation	Central areas may already be deficient in parks and open space standards; land acquisition costs are high	Levies for park acquisition and development Compensate for increased population by providing on-site amenities for residents, thereby reducing additional demands on public facilities
Public works: snow removal, street cleaning, sidewalk and sewer maintenance	No impact	
Service: garbage collection	Little impact unless hundreds of units added to a neighbourhood	Central refuse storage in project, possible compaction for more efficient operation
Public transit	More effective use of existing operations	Transit operations scaled to ridership
Parking and traffic	Review with city engineering and planning departments; infill project could add to traffic in particular and parking demand	Modify unit mix to yield fewer cars Accommodate parking impact on site; maintain on-street spaces Traffic impact may be resolvable in site-planning stages; through control of access to the site; and neighbourhood solutions (such as one-way streets)

Part 2:

Site-planning Considerations

37. The planning of new infill housing must solve the issues of neighbourhood context, site layout and the design detail of individual dwellings.

After an infill project is deemed in general terms to be feasible, the second phase is to develop in detail the physical aspects of the project.

A number of site-planning considerations arise in this second phase of the infill planning and development process. Those described in the following pages were drawn from an analysis of completed infill projects in several cities across Canada. While it is unlikely that any single infill project will be faced with all of them, the examples illustrate how the issues have been and should be resolved in different infill contexts. Figure 37 shows how an infill house can be made to fit into its particular context.

Three crucial factors must be considered in site planning for infill projects. In order of priority these are:

- neighbourhood context — the relation of the project to its immediate surroundings (figure 38)
- site layout — the arrangement of housing units, parking, access and open spaces on the site (figure 39)
- project detail — the immediate environment of individual housing units (figure 40).

The way in which infill housing is accommodated into the context of its neighbourhood is the essential element of a sensitive approach to infill housing. Infill projects are small additions to an established fabric of buildings, streets, services, and open spaces, and must take their place within existing networks of social, economic and political relationships. For example, in low-density suburban housing areas the role of the natural environment as an element to be responded to and shaped will have an importance it may not have in built-up areas.

The quality, consistency, and integrity of the neighbourhood will determine its relative importance in the site-planning process. The public aspects of a project, that is, its integration with and contribution to the neighbourhood, are of paramount importance.

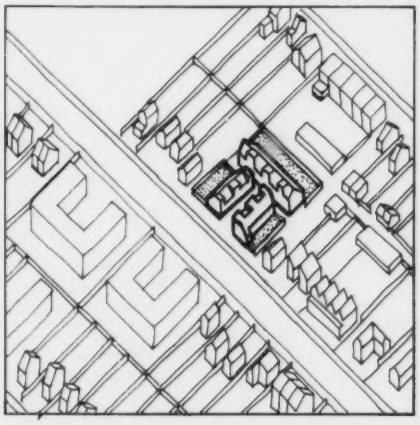
Next, the site layout of a project must meet collective human needs. The arrangement of dwellings, access, and public and private open space on the site will determine its residential quality.

Third, the project must offer features and amenities that are marketable to individual households. These elements create the immediate environment of each individual dwelling.

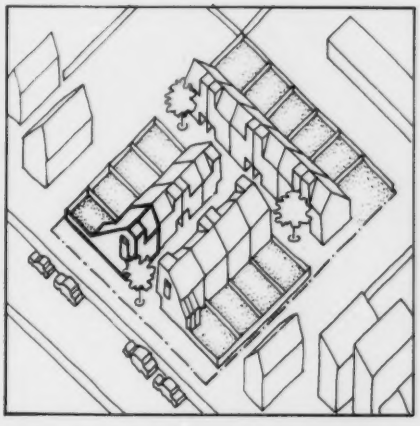
All these factors interact and some may conflict with each other. Resolving one set of concerns may lead to new problems with others. In a complex social and political setting, site-planning issues will probably also reflect the varied and sometimes opposing concerns of local officials, politicians, residents and prospective users. Different communities and site restrictions will place different emphases on site-planning issues and how they should be resolved.

The detailed site planning process, therefore, requires priorities to be set in deciding which issues are important to the success of a specific project. Tradeoffs will also be necessary after weighing and balancing conflicting considerations and possible solutions.

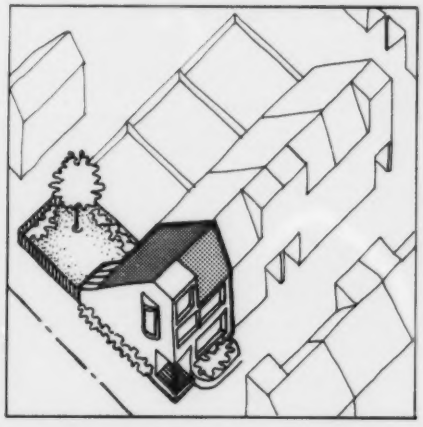
Because flexibility is required in the site planning process, performance or intent is generally more important than adherence to numerical standards. The relevant issues are discussed in the following pages. The principles that arise from these considerations are clearly laid out and design solutions are provided to satisfy the principles under different conditions.



38. The neighbourhood-context scale is concerned with the relationship between the infill project and the neighbourhood.



39. The site-layout scale is concerned with the clearly defined boundaries and spaces of the infill project as a whole.



40. The project-detail scale is concerned with the amenities provided to the individual units.

41. Traditional walk-up row housing in Quebec.

These site-planning guidelines are concerned with "good neighbourliness", that is, the compatibility of the infill project with its surrounding social and physical context, and the contributions the project can make to strengthen neighbourhood character and amenity. The elements important to neighbourhood context, and the site-planning responses to them, will vary from city to city and from neighbourhood to neighbourhood, and may have to be determined through consultation between the developer, planner, local residents and elected officials.

A central problem in infill housing development and design is the balance between the public interest in neighbourhood character and compatibility, and the diversity and identity important for marketing infill projects and individual dwelling units within them.

"Architectural character", "scale and impact" and "street frontage" are considerations that focus on the identification of important features or dimensions in neighbourhood buildings and streetscapes to which the design of the infill project can respond. It may be possible to make direct use of some of these features such as materials, or more subtle use of similar ones such as roof shapes, plan arrangements, or street setbacks. Figure 41 shows the distinctive quality of a traditional neighbourhood in Quebec. New infill housing in a neighbourhood like this would have to take into consideration its special characteristics.

Two other considerations, "neighbourhood amenities" and "existing buildings and uses", are opportunities to which the infill project can respond, to the betterment of the project and the neighbourhood. For example, an existing neighbourhood amenity may be improved by extending a park, providing a view, filling in a gap in an existing commercial street, or enhancing historic links with neighbourhood life.

Land Uses

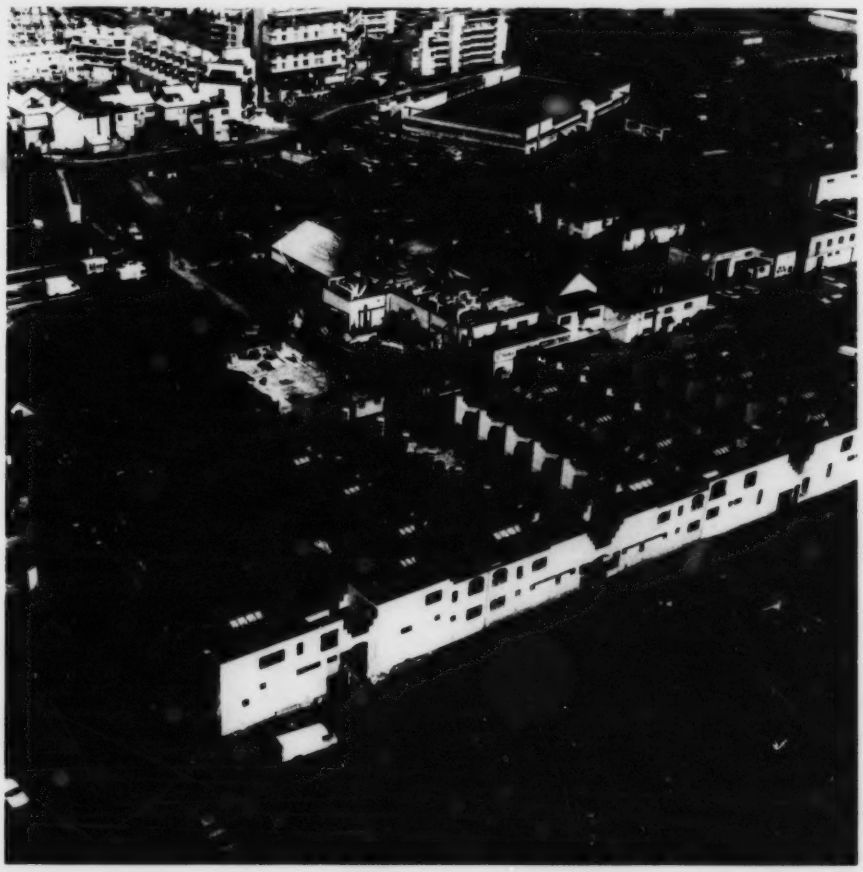
Infill projects are often located in areas undergoing changes in land use from industrial and commercial to residential (see figure 42).

Tenure and density may also be changing from low-density family and rooming house to medium-density townhouse and condominium apartment.

Infill projects may be located on the edges of stable residential neighbourhoods, or on buffer or "gap" sites between land uses such as residential and commercial, industrial, railways or major roads.

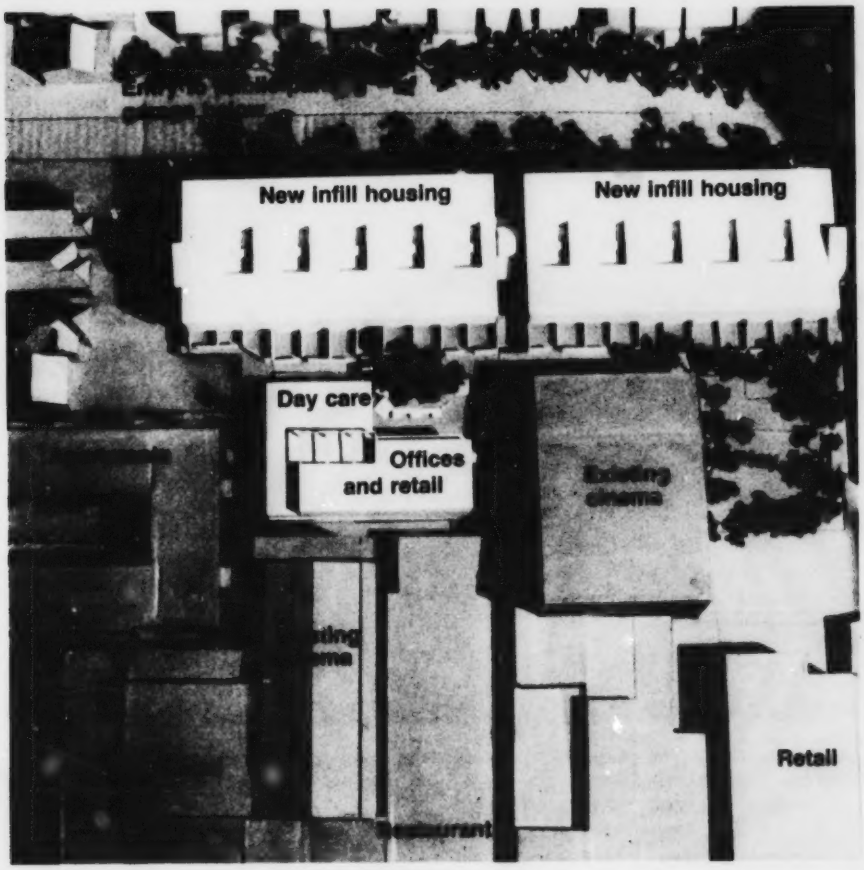
Changing neighbourhoods
In neighbourhoods undergoing change, infill residential development has a role in "smoothing" abrupt changes in the development pattern and ensuring compatibility among changing land uses.

New housing may have to be protected from the incompatible aspects of adjacent land uses, such as noise, loading, garbage, and storage areas. In turn, adjacent uses such as single-family housing may need screening from the play areas, service entries, and garbage areas of new multiple-housing projects.



42. Fairview Slopes, Vancouver, is a mixture of residential, industrial and commercial buildings in a neighbourhood undergoing change.

Transition sites
On buffer or gap sites between land uses, infill projects may have to take the role of consolidation or completion of adjacent development patterns (for example, shopping); buffering land uses from one another (such as parking lots, high-rise offices, and single-family housing); or linking uses such as housing and shopping.



43. This Alvin Avenue project in Toronto is an infill project that makes the transition between a low-rise residential street and a high-density commercial/retail area. This is accomplished by combining a public parking garage and retail and community facilities at street level and a pedestrian walkway with medium-rise housing on upper levels.

Principles

Changing neighbourhoods
New housing projects should be compatible with both existing and future land uses. The project should also be protected from the incompatible aspects of adjacent uses, and vice versa.

Transition sites
On buffer or gap sites, infill development should make the required transition between adjacent land uses within the project site itself.

Design Solutions

Changing neighbourhoods
Transitions between uses can be facilitated by including in the project adaptable space at ground level. For example, office space can later be converted to shopping for area residents.

New housing projects may have to be relatively self-contained (for example, in a courtyard scheme) if there is no adjacent strong residential component.

The service areas of adjacent parcels should be screened.

The scale and form of adjacent buildings can be used as a model for the form of new infill development.

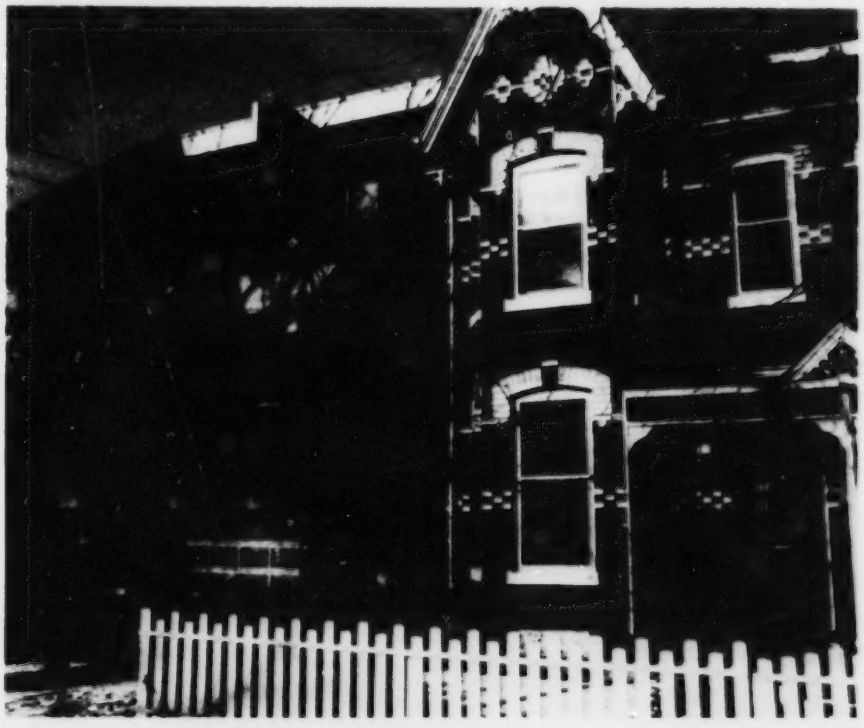
Transition sites
(Figure 43) — Extend adjacent development patterns and uses onto the site, if appropriate.

Buffer or separate (horizontally or vertically) differing land uses within the project.

Architectural Character

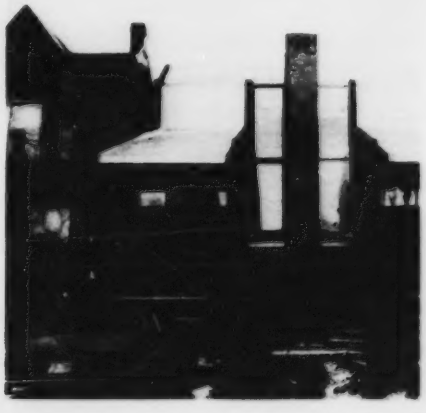
Architectural style and character in housing comprises a collection of physical attributes, including the exterior form and roof treatment, the materials and ornament employed, the window and wall treatment, and the use of elements such as porches, entries and steps.

Mature neighbourhoods in Canadian cities often have a distinct architectural character, which is the result of geographic or climatic variations, local building methods and materials, and the style of the period during which the neighbourhood was built. When this character is consistent (for example, stone townhouses in Montreal, brick Victorian townhouses in Toronto), it is important that the new infill development emulate it as closely as possible. When the character is more varied, as in younger neighbourhoods or in areas with a diverse mix of houses and industrial or commercial buildings, the pressure to conform is not as great. Figure 44 shows a successful mixture of architectural styles; figures 45 and 46 show mixes that were unsuccessful.



44. Contrasting architectural styles arising from the building methods, lifestyles and aesthetics of different eras can nevertheless be combined into a pleasing mixture that gives a neighbourhood its character.

45. With this new infill housing the post-war building style of a Vancouver neighbourhood has been disrupted by an incongruous architectural style.



46. The building form and architectural style of this new infill housing disrupts the Victorian townhouse context of a Toronto neighbourhood.

47. Roof forms in this new infill project in Vancouver repeat the pattern of existing housing.

48. The dormers and bay windows in the Trefann Court infill project in Toronto repeat similar architectural elements found in nearby houses.

Because new infill projects employ different materials or construction methods, accommodate different lifestyles and personal space needs, and respond to different problems such as accommodation of car parking facilities and emergency-vehicle access, detailed imitation of the housing forms of an earlier era is rarely appropriate.

Principles

To maintain the architectural character of the neighbourhood, new infill projects should make use of one or more of the architectural elements of nearby housing. Of greatest importance are elements with the strongest visual impact, such as building form and roof profile. Also important are major elements of the street face of houses, including window and wall treatment, porches and entries.

Second in importance are elements of detail, including ornaments, trim detail and colour, and landscaping.

Design Solutions

Site elements commonly found in nearby housing (verandahs, porches, peaked roofs, entries, etc.) can be repeated in new housing (figures 47 and 48).

Unit façades in the new project can be varied in a manner consistent with neighbouring houses.

Scale and Impact

Financial considerations usually require that infill projects be built at higher densities than existing housing. This often results in substantially greater building size, height, or intensity of use. The impact of intensification of use must be carefully considered (see figure 49). The pattern can also occur in reverse, as happened in Vancouver, where planning height limits have resulted in new low-rise infill housing in high-rise neighbourhoods (figure 50). Project scale or impact has several aspects.

Size
As housing projects increase in size (sometimes occupying as much as a city block), they tend to become organized internally, as "enclaves" within the neighbourhood, and consequently lack the direct street relationship of traditional housing.

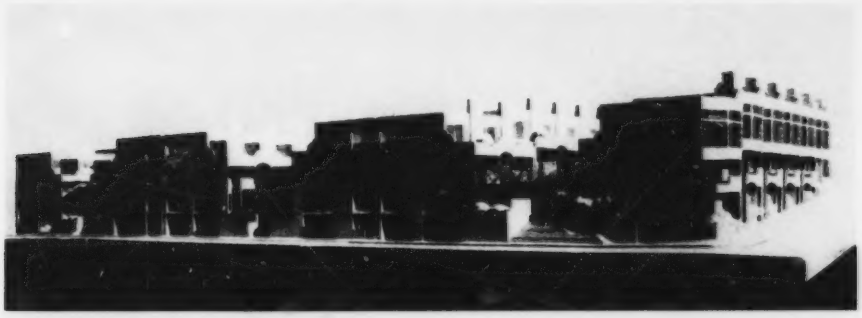
Building bulk and height
Compatibility is not always a case of relating a larger infill complex to its smaller neighbours. New housing that is too low or too narrow, can be as out of place as housing that is too high (figure 51). Where adjacent density zones differ, infill housing can effect a transition in building height between them.

Intensity of use
Housing that creates an abrupt increase in density compared with its neighbours can also cause localized traffic, servicing, or social problems.

49. The impact of the larger buildings that usually result from increasing the population density, must be considered carefully. One approach is to emphasize the individual units that make up the larger building, as was done in this Campbell-Antler project in Toronto.

50. Vancouver: high-density low-rise infill may be inappropriate when, for example, the neighbourhood context is high-rise.

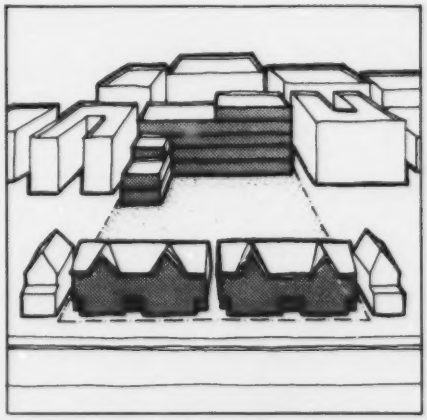
51. Because of its sloping site, the scale of this new infill project in Vancouver is too small in comparison with its neighbours.



52. To reduce impact this 40-unit infill project (Willow Arbour, Vancouver) has been divided into three clusters.

53. The setback of the upper storey on this project (Hydro Block, Toronto) was intended to maintain the existing street scale.

54. Duplex and triplex building forms can be used when the context is large estate houses.



55. "Density carriers" at the rear of the site permit lower-rise building forms elsewhere, to maintain the scale of the street.

Principle

Infill projects should be compatible in size with existing development patterns, comparable in height (in general, no more than 1.5 m or a half-storey difference) and density (in general, no more than 25 per cent greater or lesser floor-area-ratio) to existing housing.

Design Solutions

To reduce the impact of large projects, divide them into identifiable clusters, each with separate entries and different character (figure 52).

Use upper storey setbacks to reduce the apparent height of the project (figure 53).

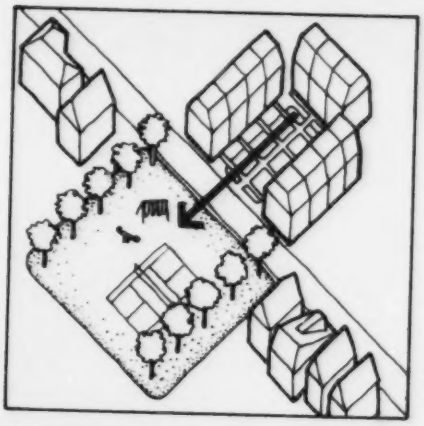
When new units are smaller than the existing ones, combine them into duplexes or larger groups to maintain a bulk and form consistent with nearby houses (figure 54).

To maintain the low scale of an existing street frontage, place higher density building elsewhere on the site (figure 55).

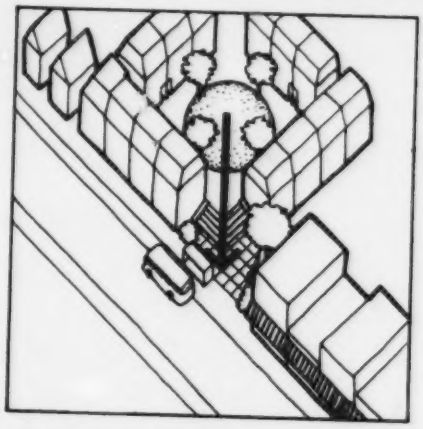
Neighbourhood Amenities

The urban neighbourhoods most sought after for infill development are often near to or have views of lakes, rivers, canals, mountains, hills, ravines, open space or downtown parks. Housing that does not take advantage of existing amenities loses potential for a distinctive character, improved housing quality and easier marketability. Views and view corridors extending beyond the site are particularly important, as they provide visual relief in constricted urban conditions. Figure 56 shows a project that makes good use of long-range views.

56. The orientation of the roof terraces of these EERA townhouses in Vancouver is toward long-range views of mountains and the city centre.



57. A project oriented toward a neighbourhood park.



58. A project oriented toward public transit and shopping.

Principle

Site planning for infill housing should try to take advantage of adjacent neighbourhood amenities through project orientation and by reinforcing attractive conditions and activities. New development should also ensure that a view, or access to it, is not spoiled for existing residents.

Design Solutions

Arrange units on the site to provide convenient access to existing neighbourhood amenities — parks, services, and public transit for project residents (figures 57 and 58).

Use angled or bay windows to gain views of significant topographical features.

Use upper level balconies and roof terraces to provide private outdoor living areas and unobstructed views.

Use the site landscape to continue or contribute to the attractiveness of public parks and open spaces.

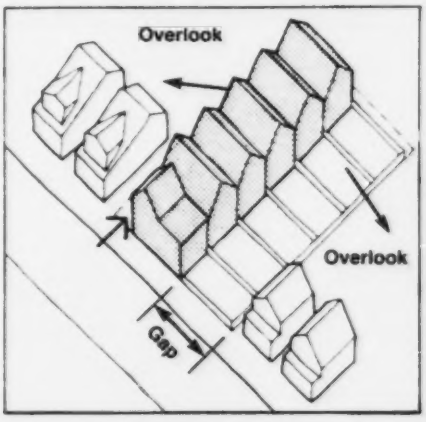
Street Frontage

A mature neighbourhood street derives its urban character from building façades and the relationships of houses, front entries, driveways and yards to the street and sidewalk. These elements in combination create a "street wall", which defines the street as a corridor or path along which pedestrians and vehicles move, and as a series of places, marked by building entries. The Montreal project shown in figure 59 maintains the character of the street frontage.

Neighbourhood patterns can be disrupted by infill projects placed perpendicular to the street. Living patterns expressed or established by front porches and living rooms facing the street disappear. The sides rather than the fronts of new dwellings face the street, traditional side yards become the rear yards of infill houses, and major gaps are created in streetscape continuity. See figures 60 and 61. The introduction of sloping driveways and garages onto a street that has previously not had them is similarly disruptive and may be dangerous for pedestrians and children.

The removal of significant elements of the streetscape can also be undesirable; for example, many Montreal streets are lined by triplex houses with characteristic outside stairs from the second floor to ground level. New buildings without these elements produce gaps in a highly organized urban setting.

59. This new infill project (centre) in old Montreal maintains the street frontage and traditional building style.



60. New development on long sites can disrupt a neighbourhood's established patterns of front, rear and side yards.

61. In this broken-up street frontage in Vancouver, the garage entry and garbage bins of one townhouse project are adjacent to the main entry of another.

62. The street front is maintained in this Toronto project. Access to other dwellings in the project is provided by the pedestrian walk-through.

Principle

Where the existing "street wall" is one of consistent height, setbacks, architectural treatment, and house/street relationships, a new infill project should maintain this continuity. Where the street wall is more varied in scale, or punctuated by a looser pattern of buildings and open spaces, more flexibility is possible.

Design Solutions

Where a project must create a gap in the street frontage (for example, a driveway or pedestrian entrance), it can be bridged by gateways, planting, building, or similar elements (see figure 62).

Where the existing street wall is a looser pattern of buildings and open spaces, new infill projects can fill in gaps in the streetscape, and respond to the context with similar forms of organization, such as open courtyard schemes.

Existing Buildings and Uses

Removal of existing buildings on and uses of an infill site may destroy the historical, physical, and social continuity they provide to the community. On the other hand, creative reuse of existing buildings can encourage the acceptance by neighbourhood residents of new development elsewhere on the site. Figure 63 is a good example.

Not all existing buildings or uses are equally valuable. Buildings in poor condition and site uses clearly incompatible with a residential neighbourhood (for example, a car wrecking yard), should be candidates for demolition or removal.

Principle

An assessment of the potential reuse of buildings on an infill site should be made before a decision is made to demolish them. The assessment should consider financial, architectural/structural, planning, and socio-economic feasibility aspects and the options that are available for relating new housing to existing structures and activities on-site. Where there is uncertainty about whether to demolish or reuse, the emphasis should be in favour of retention.

63. New units have been added in the side yards of existing houses in Belvedere Court, Ottawa.

64. This infill development on Echo/ Rosedale in Ottawa attached wings to the large existing house.

65. This detached historic house (Brown's Inlet, Ottawa) has had townhouses added along the periphery of its site.

66. The shell of a burned-out school on Percy Street in Ottawa has been converted to parking and recreational uses.

Design Solutions

There are usually several site-planning options for reusing existing buildings and retaining existing activities.

Large house on large lot
A large house can often be divided into renovated units, with new housing attached directly to the existing structure (figure 64), or added in the side or rear yards of the site (figure 65).

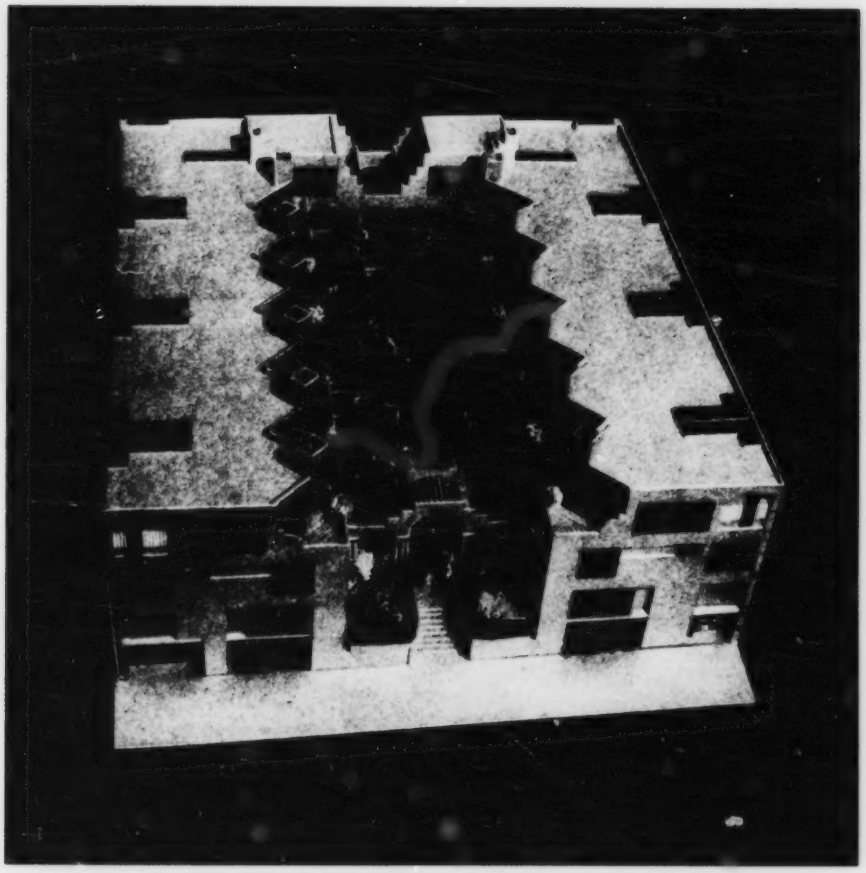
School or church sites
Existing buildings may be less adaptable for housing (because of inappropriate size, configuration, or floor-to-floor heights) but may be able to be used for activities previously associated with the site (such as day care, meeting rooms, parking, or other non-residential uses). See figure 66.

Commercial buildings
The commercial structure itself may not be adaptable to housing, but the services and retail uses it contained may be retained within the project.

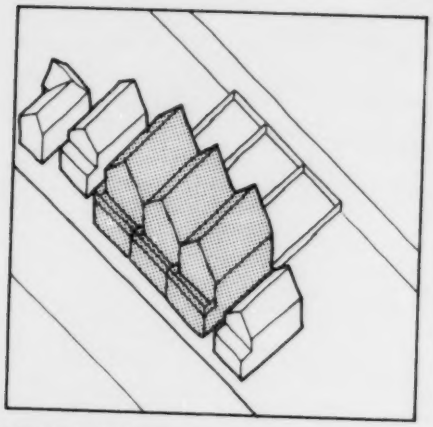
Activity area
When there is no building, but use of the site is important to the community (for example, as a public parking lot or children's play area), it may be feasible to provide for that activity in the project (for example, a garage that accommodates both existing parking demand and the parking that will be required by the new infill housing).

Site Layout

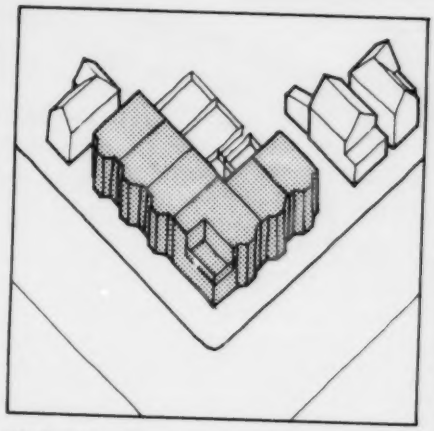
The general objectives of site layout are to achieve an efficient arrangement of housing units, private and common open spaces, and pedestrian and vehicle access and movement in the project. Infill development sites tend to be constricted. Site layout should therefore focus on making the best use of the ground plane and the upper levels for indoor and outdoor living space. See figure 67 for an example of a good site plan.



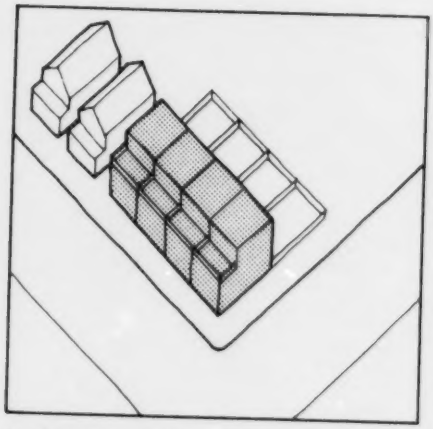
67. Site layout should focus on making the best use of the ground plane.



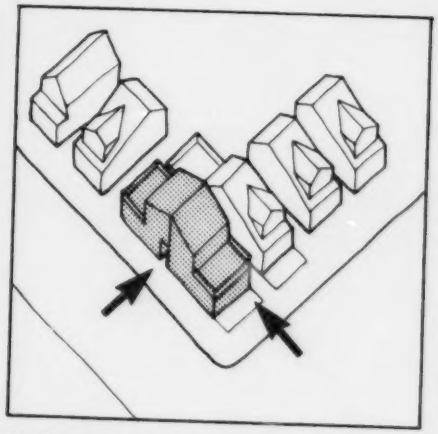
68. Mid-block site.



69. Corner site.



70. Corner site at intersection of residential and side streets.



71. Corner site with semi-detached units. Note that the units have their main entries on different streets.

Types of Site

A variety of site types is encountered in infill housing. Certain strategies apply only to a specific site type; others have more general applicability.

Mid-block or "missing tooth" site (Figure 68) — The major concern in planning this type of site is that it be compatible with the existing streetscape. Placement of new dwellings should conform to neighbouring setbacks and widths between adjacent houses. If lane access is available, it should be used, to reduce the necessity for a large number of street access points.

Corner sites (Figure 69) — The street frontage of new units should relate to both streets on the corner site. The corner unit itself should be differentiated from the others. While access may be restricted on one street, both streets can be used for addresses.

Orientation toward one street is acceptable if there are no buildings fronting on the other street. This could be a solution if there is heavy traffic noise on one of the streets (figure 70).

A semi-detached house form can be used on small corner sites, with addresses on both streets (figure 71).

Long sites

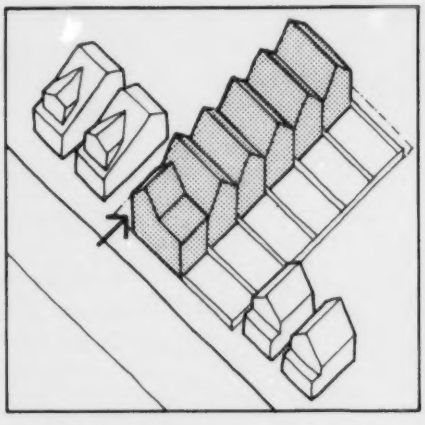
(Figure 72) — Units at right angles to the street should be avoided; they create gaps in the street wall and place units at right angles to the normal development pattern.

Placing units parallel to the street will maintain the street wall. Where units are placed behind units, create a gateway for exposure and access to the site (figure 73).

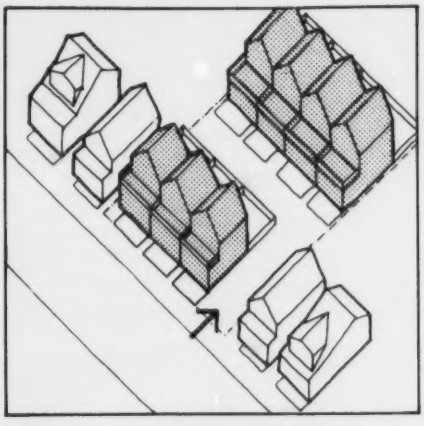
Large sites

(Figure 74) — The "exploded box" has units parallel to the street and the rear of the site. The frontage will maintain the street wall, but the "houses behind houses" may need a major gateway or entry for adequate exposure.

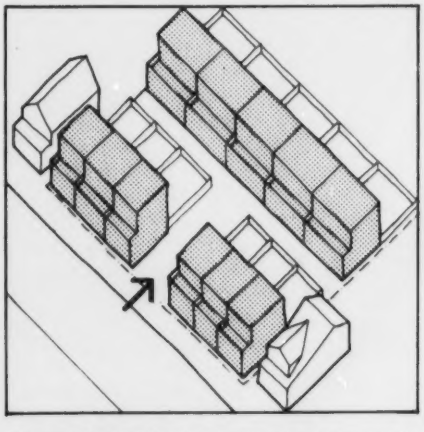
A variation on the "exploded box" has units parallel to the side lot lines, creating a gap in the street wall. Units are at right angles to the normal pattern (figure 75). A layout that provides more street-front units may be a more acceptable solution (figure 76).



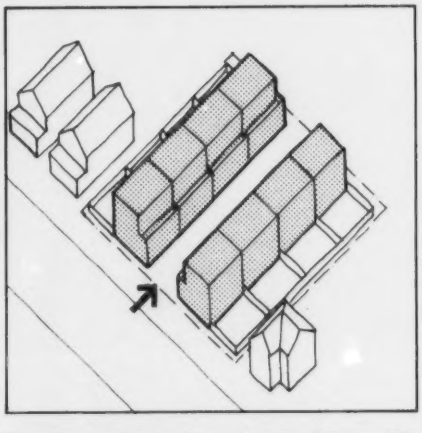
72. Long site with new housing perpendicular to street.



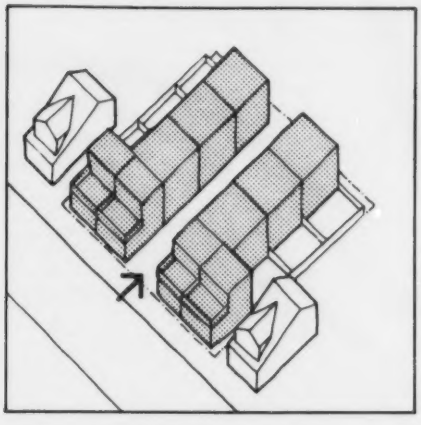
73. Long site with new housing parallel to street.



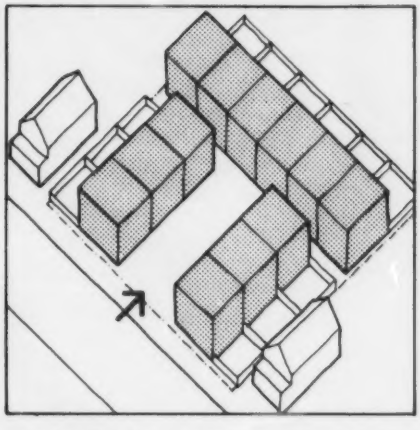
74. "Exploded box" courtyard scheme with housing parallel to street.



75. "Exploded box" courtyard scheme with housing perpendicular to street.



76. Large site with street-front units.

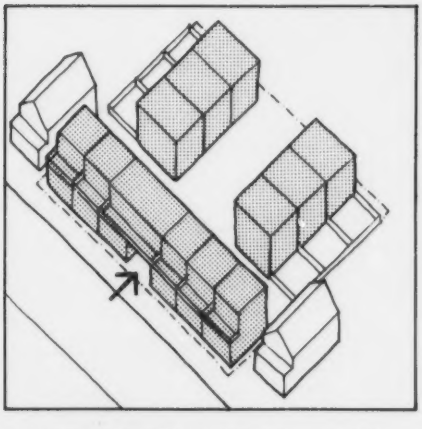


77. Large site with U-shaped courtyard open to street.

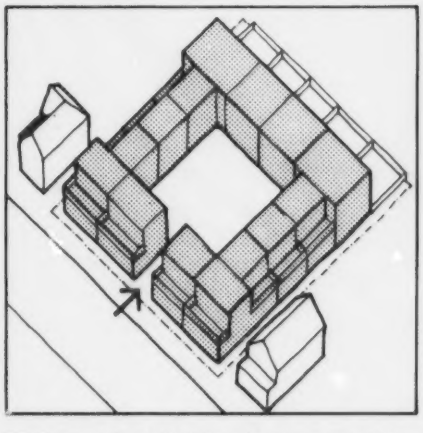
The U-shaped courtyard creates a central open space, with some units at the rear of the site. However, this arrangement creates a gap in the street wall and some units are at right angles to the normal pattern (figure 77).

A better U-shaped courtyard arrangement is shown in figure 78. It maintains the street wall, but the entry to the rear units is through a gateway.

The "doughnut" plan in figure 79 maintains the street wall, but may limit private open space for individual units. A lobby or directory near the project entry is required. Interior corners may reduce the courtyard frontage of some units.



78. Large site with U-shaped courtyard that has strong street presence.

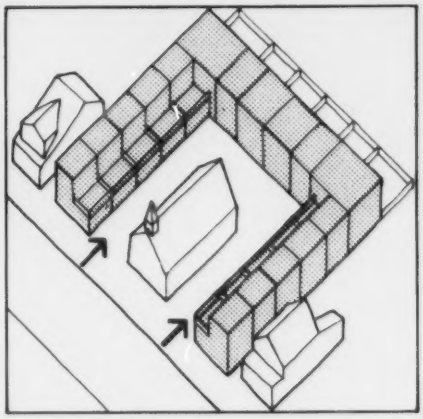


79. Large site with "doughnut" courtyard.

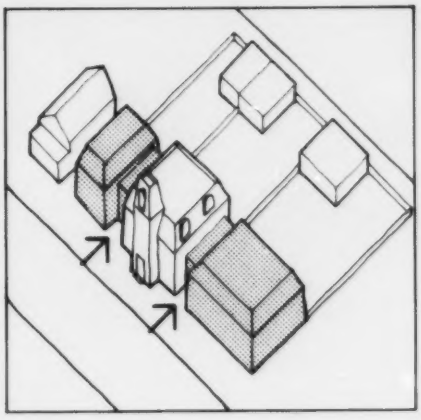
Existing buildings of character
An existing building can be a focal point for new development, but if the old structure is a house, it may lose some of its privacy (figure 80).

New dwellings can be directly attached to the existing building, but if they are, it is important to make sure they defer to the stronger character of the old structure (figure 81).

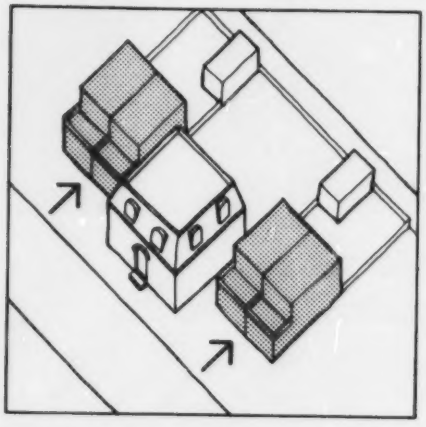
Side yard development in which new buildings are separated and set back from the existing historic property will permit greater variation in architectural character for new developments. Care must be taken, however, to maintain the "position" of the existing building (figure 82).



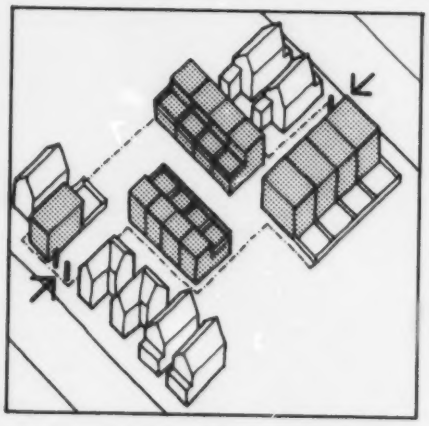
80. Existing building with peripheral development.



81. Existing building with direct attachment.



82. Existing building with separated side-yard development.



83. Unusual site with new buildings scattered to make best use of the site.

Unusual sites
(Figure 83) — Unusual site conditions largely determine the site layout. The site may have restricted or remote access, in which case gateways can be used to "announce" the project to the street.

Rear-lane access for vehicles should be used where available to preserve the street frontage.

As many units as possible should be placed facing onto the street. This provides the same direct access to units as traditional houses, and maintains the continuity of streetscape.

If some units cannot face the street directly, a focal point, such as an open space oriented to the sun, should be created from which entries to all units can be seen.

Natural Features

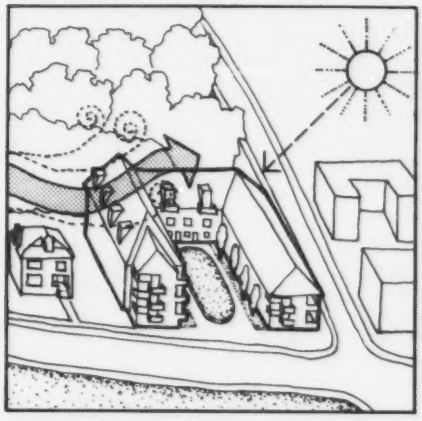
Urban infill sites tend to lack significant natural features; certain conditions, however, such as micro-climate, topography, soil character and vegetation affect all sites. Appropriate site-planning responses to these elements can make a significant contribution to the amenity and character of housing. See figure 84.

Micro-climate
Climatic conditions within a project are important to the usability of its open spaces and can be affected by adjacent open spaces and taller buildings that may overshadow the site or create wind turbulence and snow-drifting problems.

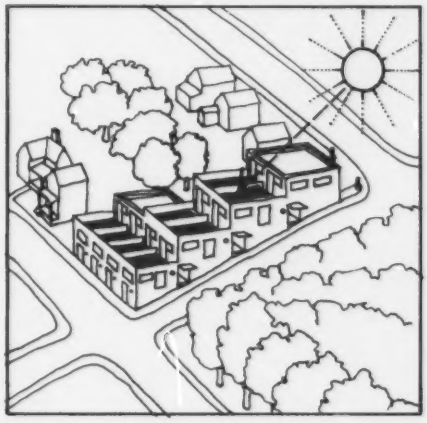
Topography/soil conditions
Layout and soil conditions can affect vehicle access to the site, the feasibility of underground parking garages, excavation, foundation, and construction methods.

Major vegetation
Mature trees are often characteristic and important resources of developed neighbourhoods and can be natural focal points for an infill housing project. New construction may alter site drainage patterns, and affect the trees both on and near the site. Protection of major trees with extensive root systems will require specialist care during construction.

84. Laurel Court, Vancouver, has units that step down with the slope and provide a good view of the city centre.



85. The micro-climate within the site must be considered.



86. North-facing units on a north slope can have a sunny outdoor living area if roof decks are used.

87. Plants and mature trees can be used as a focal point on the site.

Principles

Micro-climate
Site layout should direct sun to the outdoor living areas and communal open spaces of the project, and shelter these spaces from wind turbulence and snow drifting.

Topography/soil conditions
Site layout should take advantage of the opportunities afforded by topography to provide daylight and grade access to units, reduce the apparent scale of the project, provide views, and resolve privacy and overlook problems.

Vegetation
Where feasible, large trees should be retained and protected during and after construction.

Design Solutions

Micro-climate
Building form can be used to create sun-oriented and wind-sheltered open spaces (figure 85).

Topography
The topography of the site can be used to:

- step the building with the slope to reduce its apparent scale and provide long-range views (figure 85)
- vary roof lines to allow sunlight into adjacent units (figure 86)
- enable the slope to provide grade access to stacked units.

Vegetation
Locate the project entry and communal open space to make use of existing trees as focal points (figure 87).

Parking

Project parking requirements depend on two factors: the needs of different types of residents and the location of the project. Typical parking requirements are two cars per household for upper-income families, 0.5 to 1 car per household for single people and smaller families, and 0.3 cars per household for senior citizens. Visitor parking requirements are generally 10 to 25 per cent of residents' needs.*

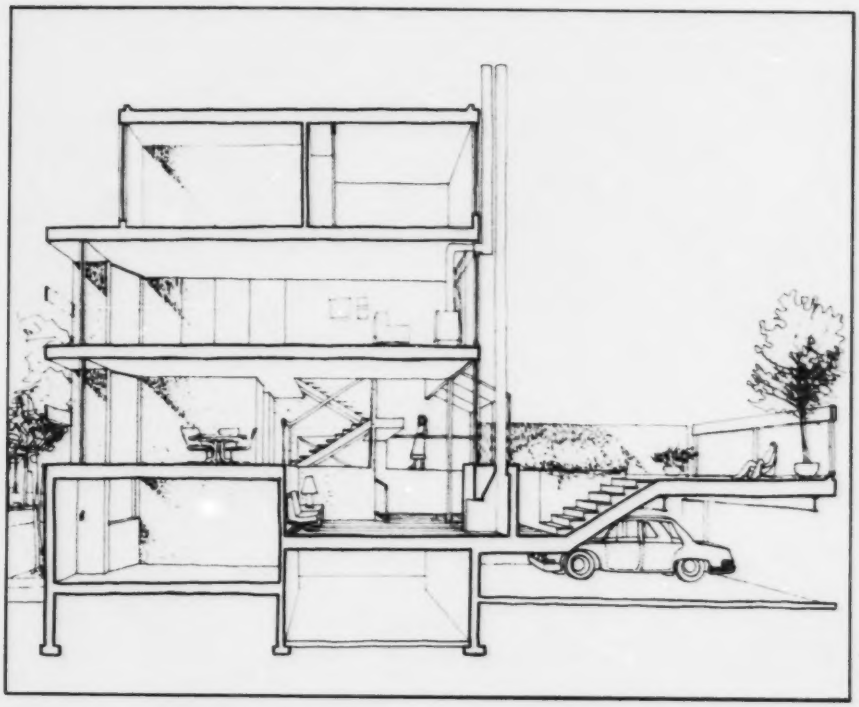
In central neighbourhoods with good public transit, these standards may be relaxed if it can be demonstrated that actual car ownership and use will be low, and that on-street spaces are available in the immediate area for temporary visitor parking. It is possible, however, that lower standards will conflict with municipal regulations and cases may have to be argued on an individual basis.

New infill development should not, under any circumstances, worsen the neighbourhood parking situation especially if there is already a shortage of parking spaces for residents and visitors in the area.

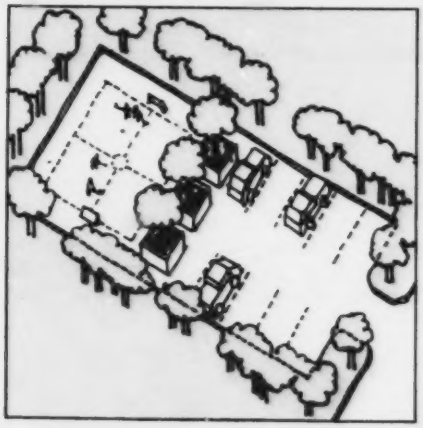
The provision of parking on a constricted urban site is often difficult. On-site surface parking is not common in mature neighbourhoods developed before universal car ownership, and is usually unattractive. Private garages at grade provide security and direct entry to dwelling units, but driveways and garages use up valuable site area and prevent use of the ground plane for private and communal outdoor living areas.

88. Meeting parking needs is more than simply paving the rear yard.

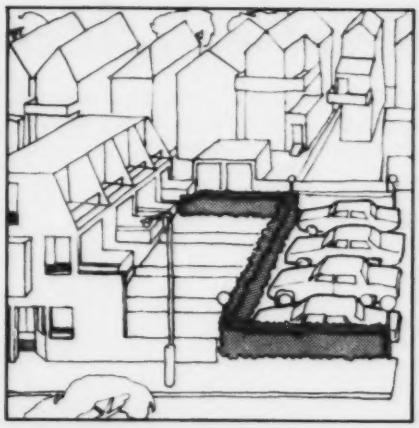
* For more information about parking see *Parking Areas: Advisory Document* NHA 5239, Canada Mortgage and Housing Corporation, 1980.



89. Here, the roof of a parking garage has been made into an outdoor deck.



90. A long narrow parking lot can be divided to provide additional recreation space if it is not immediately required for parking.



91. Surface parking areas should be screened from the street and from outdoor amenity areas.

While communal underground parking does not use up site ground area, it is much more costly than parking at grade. It may also cause security problems as cars are not under the direct supervision of unit occupants. Any reduction that can be made in parking requirements on the basis of location or low expected usage will result in improved use of the site and substantial cost savings per unit. Figure 88 illustrates a poor solution to a parking problem.

Principle

Sufficient on-site parking should be provided to meet resident and visitor needs. Factors that should be taken into account in determining these requirements include project location, access to public transit, and car usage of residents. Parking spaces should be:

- convenient, though not necessarily with direct access from the parking space to the dwelling unit
- screened from private and communal outdoor living areas
- secure, or at least allow visual surveillance from the dwelling unit
- as few as practical, and take up as little of the ground plane of the site as possible.

Design Solutions

The roof of grade-related parking garages or carports can be used as a new "ground plane" for outdoor decks and recreation space (figure 89).

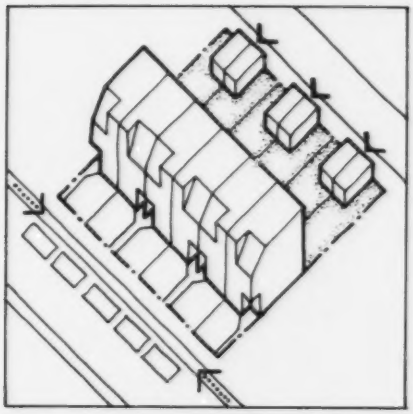
Parking lots can be designed to accommodate other uses and can be integrated with site landscaping when cars are not present (figures 90 and 91).

Vehicle Access

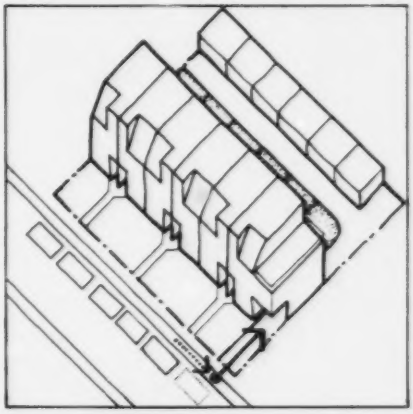
A private driveway is the ideal of most residents. However, private driveways extended over a number of street-related units can result in so many driveway access points that space for on-street parking is lost. With narrow frontage houses (6 m and less), garages and driveways may take up the entire street length of the project (figure 92). To avoid this occurring, some limit on the number of vehicle access points to a project may be necessary. Municipalities sometimes limit the number of entries to a site from arterial and collector streets, and access is generally not permitted near intersections.

Access for emergency vehicles must also be taken into consideration. When access is available from both the street and a rear lane, an emergency route through the project may not be required. However, long deep lots with no rear lane may require a side lane, at least part way into the site, for emergency use.

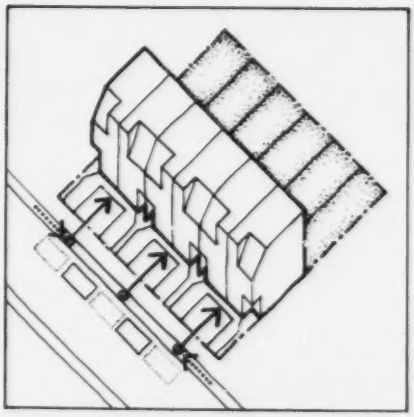
92. This repetition of walks and driveways should be avoided. It virtually eliminates front yards and street parking.



93. Lane access retains on-street parking, allows large front and rear yards and reduces pedestrian/vehicle conflict.



94. Street access with one entry retains on-street parking, provides large front yards, results in smaller rear yards, reduces pedestrian/vehicle conflict.



95. Street access with multiple entries removes on-street parking spaces, leaves only small front yards, provides large rear yards, creates pedestrian/vehicle conflict.

Principle

The number of vehicle access points to an infill project should be kept to a minimum.

If a lane exists at the rear of an infill site, it should be the primary means of vehicle access; this will retain the street for pedestrians, front yards, and on-street visitor parking (figure 93). If no rear lane exists, primary access must be from the street, but the number of driveways into the site should be kept to a minimum to prevent too many sidewalk interruptions by curb cuts, reduce car/pedestrian conflicts, retain on-street spaces, and provide opportunities for landscaping, in both the public domain (for example, sidewalk trees) and private front yards. See figures 94 and 95.

Design Solutions

Group individual driveways together to create a shared entry for two or more parking spaces. Retain on-street parking between shared entries. In a condominium project, the shared entry can be part of the common spaces of the complex. In a freehold project, the shared entry can be secured with easements across individual lots.

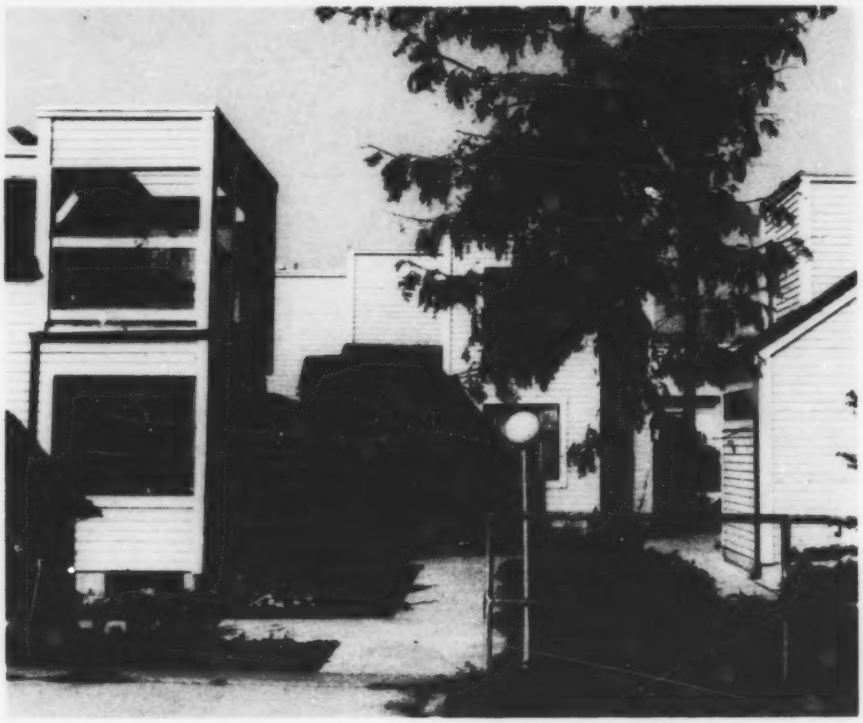
Where no rear lane access is available, curb cuts should be kept to a minimum to reduce sidewalk interruptions, permit on-street parking, and allow greater opportunity for street trees, ground level landscaping, gardens, and entries.

Pedestrian Access

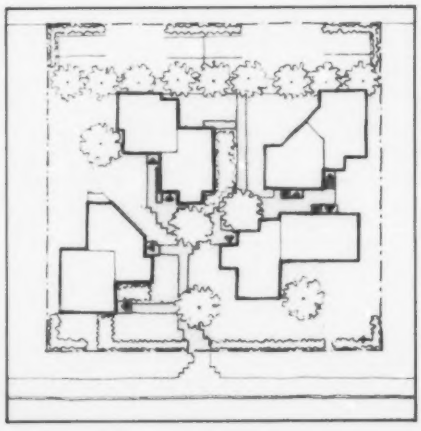
The provision of easy and direct pedestrian access to the infill project and to individual dwellings within it is important for residents and visitors. Units lacking a street frontage can be difficult to locate. A pedestrian route linking off-street units and the public street is central to the identity and address of the units. The pedestrian route also provides access to any communal spaces of the project.

The form of pedestrian access in a project is also important. Just as street access is preferred to off-street or courtyard access for easier identification of units, grade level access is preferred to corridor access, because with grade level access individual dwellings are more easily personalized and located.

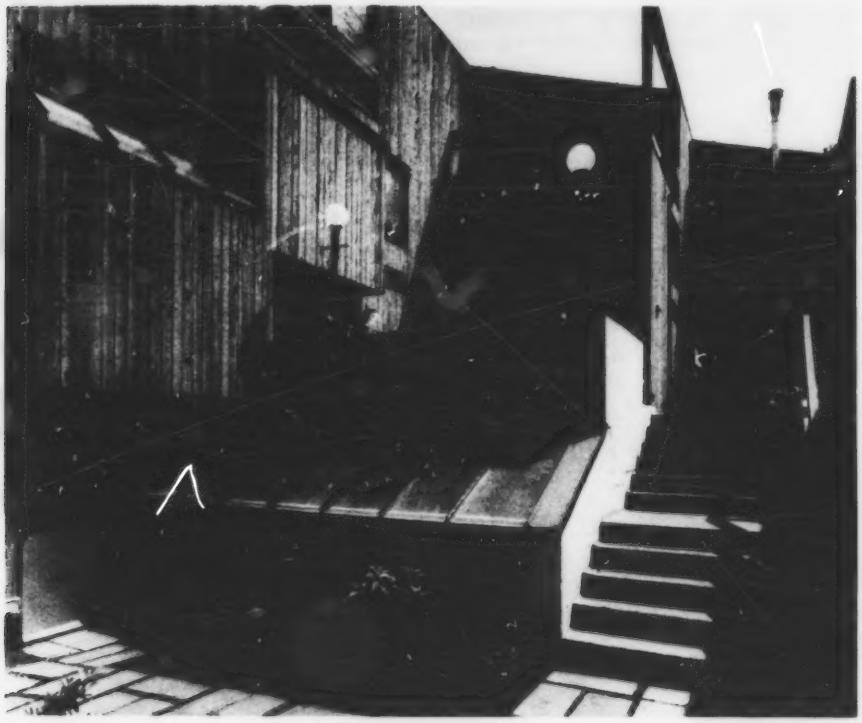
For small projects (under 10 units or so), the pedestrian walkway system can be relatively simple and linear; with larger projects (20 units and up), the walkway system may have to be more elaborate with a single street entry, and a central focal point with secondary branches radiating from it.



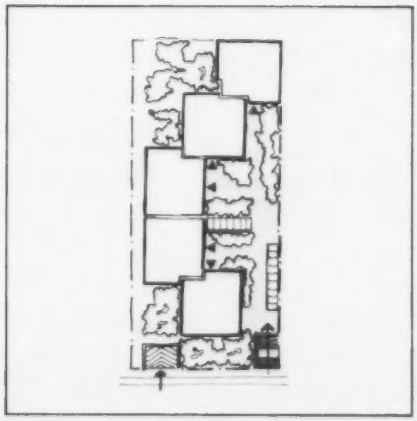
96, 97. This infill project in Vancouver has pedestrian-courtyard access to eight infill units. The pedestrian path is clearly defined and is set back from the units by planters and ground cover.



97.



98, 99. The building form in this Vancouver project was planned to create an entry forecourt from which all individual unit entrances are visible.



99.

Principle

A pedestrian walkway system is essential for any infill project with units that lack street frontage. It should meet a number of performance criteria:

- safety: potential conflicts between cars and pedestrians should be avoided
- orientation: the access route should be clear, and the address and location of each unit be easily identified from the project layout
- easy access for the handicapped: the needs of both handicapped residents and visitors should be a primary consideration
- surveillance: the pedestrian walkway should be visible from the street and from individual units
- shelter: protection from rain or snow should be provided where feasible
- lighting: the pedestrian walkway must be well lit, particularly at changes in grade or direction
- maintenance: walkways and plants should require little maintenance
- security: informal or formal control of entry to the project may be necessary.

Design Solutions

Differentiate the semi-public nature of pedestrian routes from other spaces in the project with characteristic materials, planting, changes in level, and other design details (figure 96 and 97).

Design building form to create an entry forecourt from which all unit entries are visible (figure 98 and 99).

Communal Space

In shared forms of tenure (such as cooperatives and condominiums), communal spaces have several important roles.

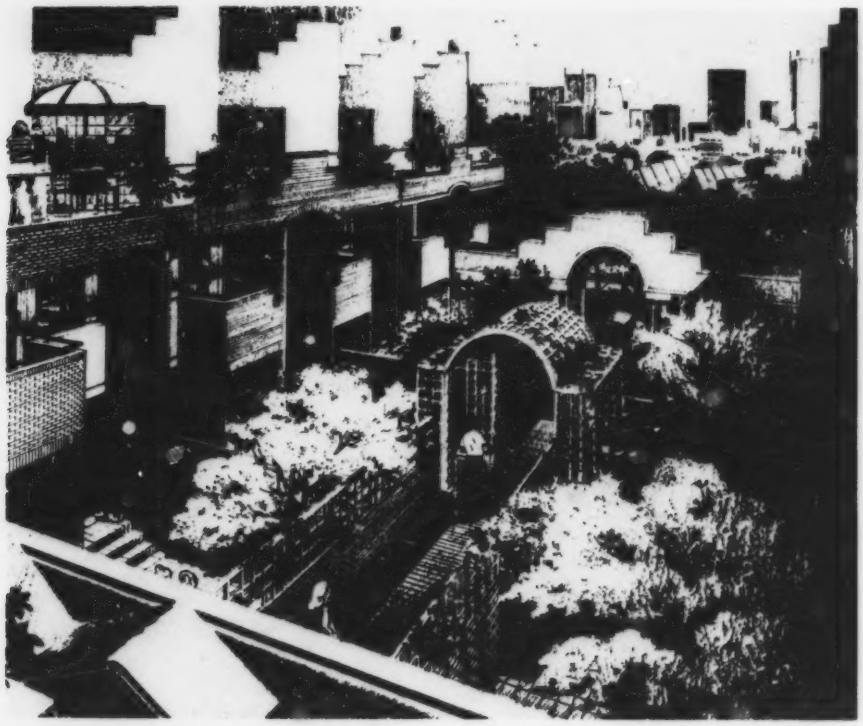
Socialization and recreation
Most recreation space in a housing project will be provided in private outdoor living areas linked to each dwelling unit. Some areas for informal group play or social contact are important, however, when families with children, or the elderly live in the project (see figure 100). As most infill projects are relatively small in scale more elaborate shared recreation facilities such as swimming pools or tennis courts are not common, although a meeting/recreation room may be necessary.

Communal spaces for recreation and social activities are less suitable for small rental and freehold infill projects unless the responsibilities for maintaining the spaces are well defined.

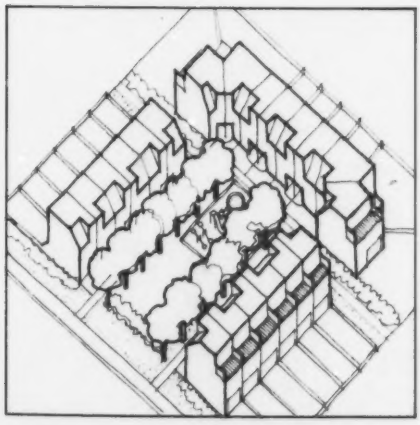
Entry transition
Larger infill projects need a buffer or transition space between the public street and the semi-private unit entries (particularly if the entries are located well away from the street). This space defines the "territory" under control and assists surveillance of the project by residents. When all units have direct street access, the transition zone is provided by the front yards of each unit.

Orientation and focal point
In larger projects (20 units or so) with more complex site plans, the pedestrian walkway system may have to be enlarged to become a central space with access to all units. This central space is particularly important to orient visitors and delivery persons, and possibly to provide emergency access for ambulances, police and fire fighters.

100. Communal space is provided here for adult socializing and children's play.



101. In this Vancouver project, the communal space provides entry transition. Differentiation of semi-public and private spaces is indicated by site elements (the arbour) and landscaping. The amenity area is oriented to long-range views.



102. This courtyard or "exploded box" building form creates a central open space. Visual extension of the project's open spaces can be achieved by relating buildings to adjacent parks, ravines, plazas and so on.

Principle

Communal spaces should be designed to support the roles and activities of social contact, recreation, entry transition, and orientation. Important qualities for communal spaces include:

- durability: surfaces and plants should require little maintenance
- safety and security: lighting, ramps and handrails should protect against hazard in any weather conditions and allow surveillance from individual units
- visibility: all units should be visible from a central focal point in the project
- differentiation: semi-public communal spaces should be limited to, and differentiated from, the public street and semi-private unit entries and forecourts
- environment: plants, privacy screening, appropriate orientation, and equipment should be provided to accommodate all outdoor activities.

Design Solutions

Differentiation between public, semi-public, and private areas can be achieved with site elements such as gates, changes in level, barriers, changes in direction and lighting, and amenities such as furniture, planters and fountains (figure 101).

"Exploded box" placement of units around the periphery of the site will create a central open space (figure 102).

Multiple-use layering of functions can provide communal open space — for example, on top of a parking garage roof.

Building Separation

Buildings are separated to allow daylight, ventilation, views, and visual privacy to habitable rooms in the dwelling; to create private outdoor spaces; and to provide solar access to south-facing walls and roofs. The often constrained site conditions of infill projects may make adequate separation for each purpose difficult to achieve. Figures 103 and 104 show two quite different ways of handling building separations.

Daylight
A volume of unimpeded space outside and above each window must be provided to allow habitable rooms to receive daylight.

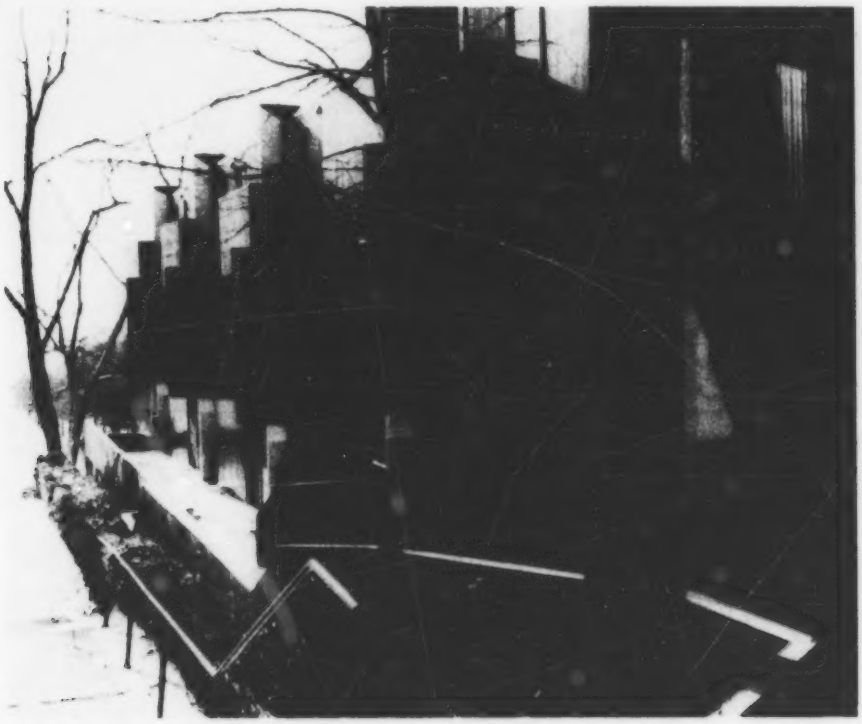
Visual privacy
Occupants should be able to enjoy privacy within their dwelling without drawing the curtains. Visual privacy is a particularly difficult problem if the windows in one dwelling face the windows in other nearby units.

Views
It is important to provide the principal living areas of the dwelling with long-range and attractive views.

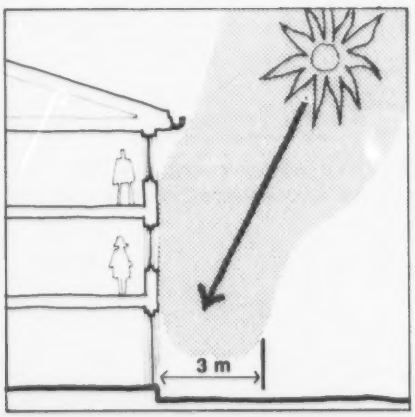
Ventilation
Habitable rooms require ventilation. This requirement is usually satisfied by providing windows that open in a room that receives adequate daylight.

Solar access
Unimpeded sunlight to a south-facing wall or roof must be provided for active or passive solar heating systems. In mature neighbourhoods, solar access is often impeded by existing buildings, trees, and lot orientations.

103. Narrow, sunless passages like these should be avoided; they have serious privacy and view problems.



104. Windows can be oriented toward views and open space.



105. Unimpeded space adjacent to windows is necessary for light to enter.

Principles

With the varied and complex conditions of infill sites, satisfaction of the performance objectives of building separation is generally more important than rigid adherence to numerical standards.

Daylight
Provide a volume of unimpeded space adjacent to the windows of habitable rooms to ensure adequate daylight access. As a practical minimum, this volume should be not less than 3 m deep (figure 105).

Privacy
The privacy zone is the central 90° cone perpendicular to the window. Generally this is the most restrictive building separation. Commonly accepted standards for this cone extending from a principal (living room) window are:

- 15 m to a facing window in another dwelling (figure 106)
- 11 m to a facing window in another dwelling where there is an intervening privacy screen (figure 107)
- 3 m to a blank wall, walkway, or public open space (figure 108).

Shorter distances may apply for other windows in the dwelling.

Views
Unimpeded views should be provided for the principal living area of the dwelling.

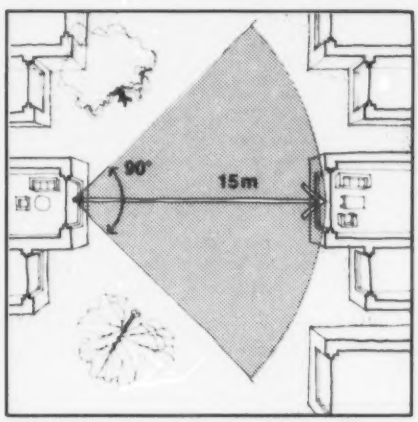
Solar access
Position the dwelling so that it receives sun on the south wall or roof, and does not block solar access to adjacent buildings. Access criteria are based on duration of solar penetration (usually 9:00 a.m. to 3:00 p.m., or the daylight period when the sun is above an altitude of 10°) for a winter day when shadows are long (usually 21 January). The lengths of shadows (and therefore the required separation distances between buildings) depend on the latitude of the building site and other factors such as land slope (figure 109).

Design Solutions

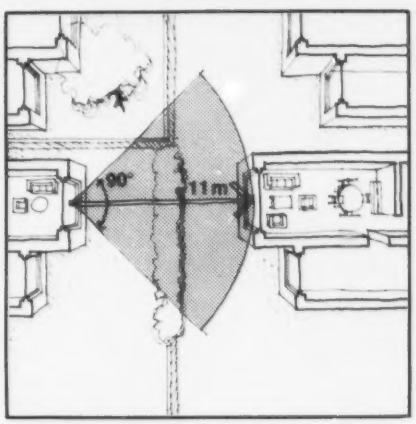
Privacy
Some of the most restrictive (that is, the greatest) separation distances can be avoided by ensuring that principal windows in a dwelling are positioned so that they do not face windows in other dwellings. For example:

In plan:

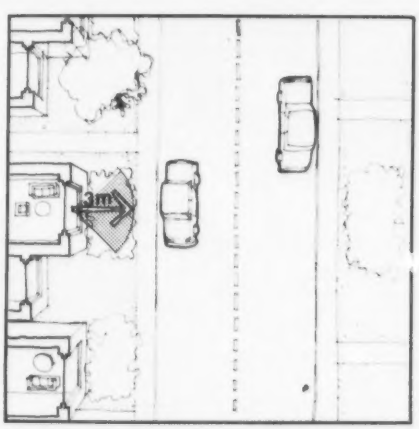
- face windows to the street or public open space
- face the principal windows of all units in the project in one direction
- orient units away from other units (figure 110).



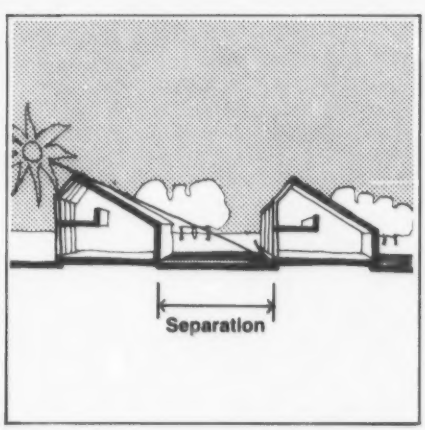
106. Make sure there is enough space between buildings when principal living room windows face each other.



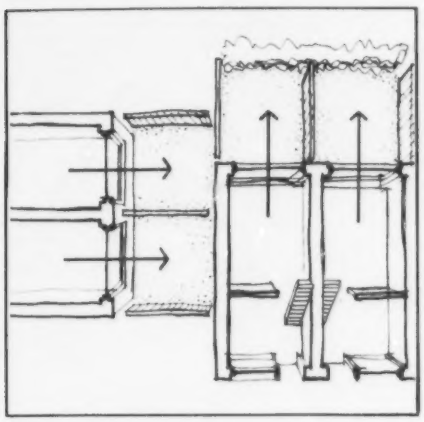
107. Separation distances can be reduced if intervening screening is provided.



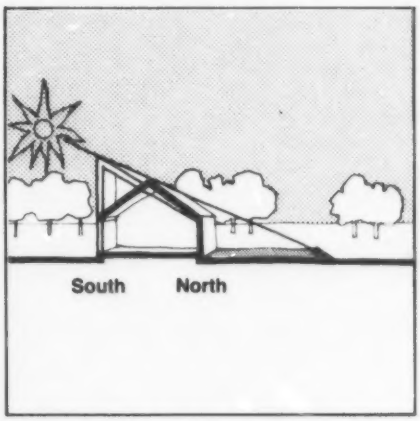
108. Less setback is necessary when principal windows face the street or public space.



109. Provide unimpeded access for the sun's rays.



110. Orient room windows to different directions to improve privacy between dwellings.



111. Buildings can have higher south walls. North walls should be kept as low as possible.

In section:

- use level changes within the dwelling, and barriers outside, to avoid direct views into living areas.

Daylight, view
Angle principal windows towards views and the sun (figure 104).

Solar access
To receive sun:

- position the building to the north side of the site
- make the south wall of the building high enough to receive winter sun (figure 111).

To provide unimpeded solar access to other buildings:

- make the building, and particularly the north wall, as low as possible
- place higher buildings on the site so that the shadows they cast fall on roads, parking areas and other site areas not intended for active communal or public use.

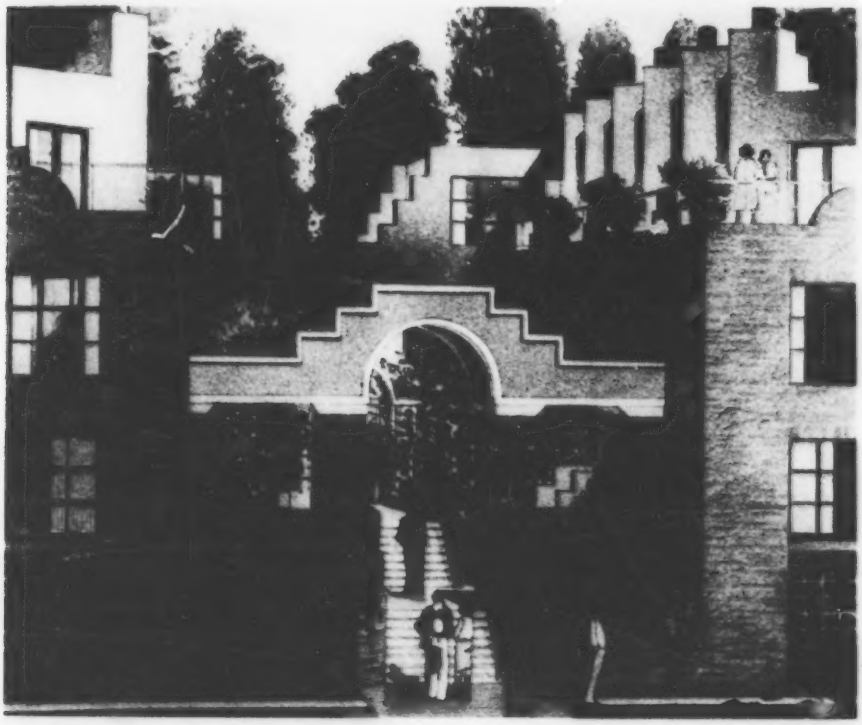
Project Identity

A distinctive project identity is important for several reasons:

- to assist in marketing the project
- to strengthen a common identity or interest (this is particularly important for communal forms of tenure such as cooperative housing and condominiums)
- for easy identification or location of the project in the neighbourhood by visitors.

Project identity must balance the desire for residents to distinguish their own individual dwellings within a larger project grouping and the community's need to maintain the existing character of a neighbourhood. See figure 112.

112. A distinctive project identity aids marketing, recognition and personalization. This one in Vancouver is a good example of clear project identity.



113. The gateway to the central courtyard of this Vancouver project provides a focus of identity.

114. This beautiful old iron gate lends distinction to an older infill project in Toronto. Both were built about 1890.

Principle

Multiple unit infill projects should have a distinct and unified character as seen from the neighbourhood, with well-defined project territory, entry, and address.

Design Solutions

Unified character can be achieved by building form, roof profile, and architectural elements such as façade materials and finishes common to a number of units of varied height and width.

Distinctive identity can be achieved by gateways and entries, and definition of project territory through site landscaping, walkways and courtyards. Figures 113 and 114 are good examples of distinctive treatment. Architectural forms and materials that contrast with nearby housing will distinguish an infill project from its neighbours, but the forms and materials must also be selected for compatibility with neighbourhood character.

Setbacks

Setbacks establish the placement of buildings on a site relative to the lot lines. The rear yard setback is usually defined to give a usable private open space oriented to the unit, and is generally the largest of the yard setbacks described in local bylaws. Inappropriate setbacks can cause problems (see figure 115). Typically, the rear yard is a minimum of 6 m to 7.5 m in depth for low-density urban housing (figure 116). Shorter setbacks are sometimes permitted for higher density apartment buildings.

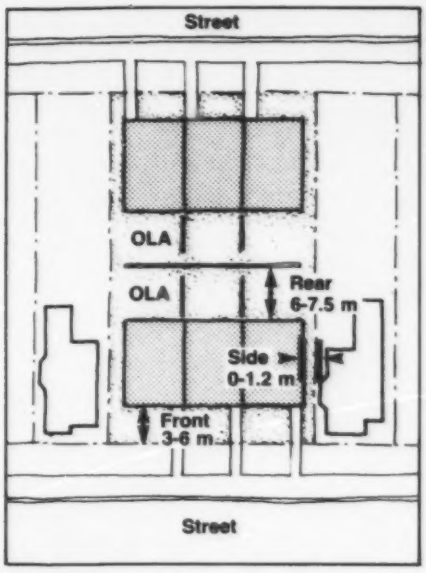
Setbacks and building separation distances often coincide. The sum of two rear yard setbacks where living room windows of opposite units face one another, should equal, or be greater than, the minimum building separation distances required for the same conditions.

Side yards are defined as areas to give access from the front to the rear of the site, to provide daylight to side windows, and to provide minimum facing distances between walls for fire separation as required in applicable building codes.

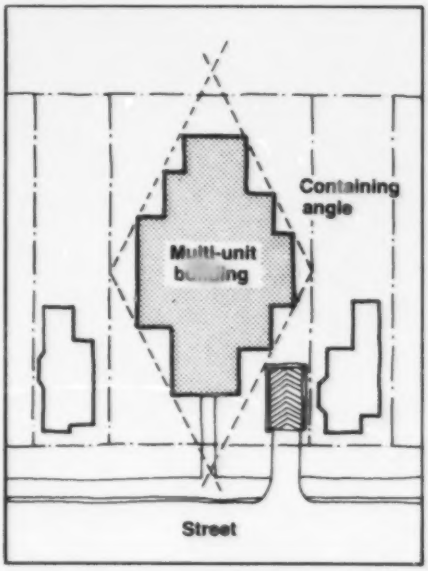
Typically, side yards will range from 0 m (for example, attached housing and mixed-use zones — no windows permitted) to 1-1.2 m (detached housing), to 3 m and up for apartment buildings.

Setbacks may also be defined in terms of "containing angles", within which the building must fit on the lot. The purpose of this form of setback is to provide daylight to habitable rooms (figure 117).

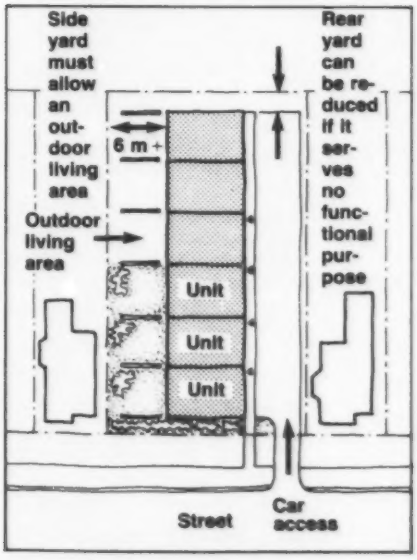
115. The inappropriate setback of the new building in this Vancouver project creates a gap in the "street wall". The forecourt it creates has limited use or attractiveness (but does conform to municipal bylaws).



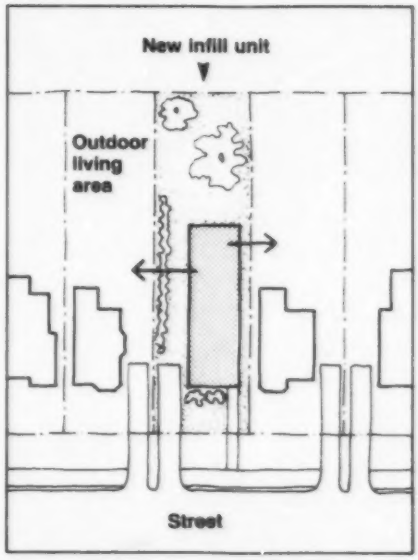
116. Conventional house and lot relationship.



117. Containing angle of 135°. Containing angles are used to assure daylight to habitable rooms on all sides of building.



118. Long-lot condition where living areas face side yards rather than front or rear. Development can disrupt conventional patterns of yard use.



119. Potential rear-yard overlook problem because new units are longer than existing houses.

In some infill housing projects, particularly those perpendicular to the street or "houses behind houses", living rooms and outdoor living areas may face side or even front yards (figure 118). In such cases, setbacks must be adjusted to provide sufficient space for their intended functions (for example, side yards increased to provide a usable outdoor living area, rear yards decreased if they are not intended to be used as outdoor living areas).

In older neighbourhoods, existing houses may not meet present municipal setback requirements because of street widenings that have reduced front yards, or changed municipal regulations to accommodate car parking on a driveway on site, and so on. A new infill unit that meets present setback requirements may not be in harmony with the streetscape of the neighbourhood.

Infill units may also be longer than adjacent houses, and protrude farther into the rear yard areas than neighbouring houses (figure 119). Care should be taken in site layout to avoid overshadowing or overlook problems for existing houses.

Principles

On streets where the front setbacks of existing buildings are consistent, new infill units should respect this consistency with similar setbacks. Where front setbacks are more varied, new dwellings should be placed mid-way between adjacent neighbours (figure 120).

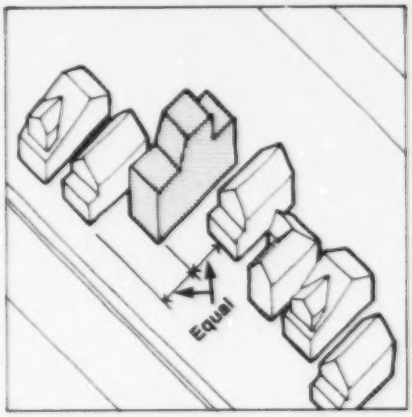
When the front setbacks suggested by neighbourhood practice, and functional requirements such as privacy, do not coincide, neighbourhood practice should take precedence if functional needs can be achieved by other means (for example, privacy screens or changes in level).

Other setbacks should be large enough to accommodate outdoor activities related to interior spaces in the unit. Under constricted setback conditions (for example, zero lot line), changes may be required in the internal layout of the unit and location of windows to preserve privacy, maintain daylight access, and avoid overlook.

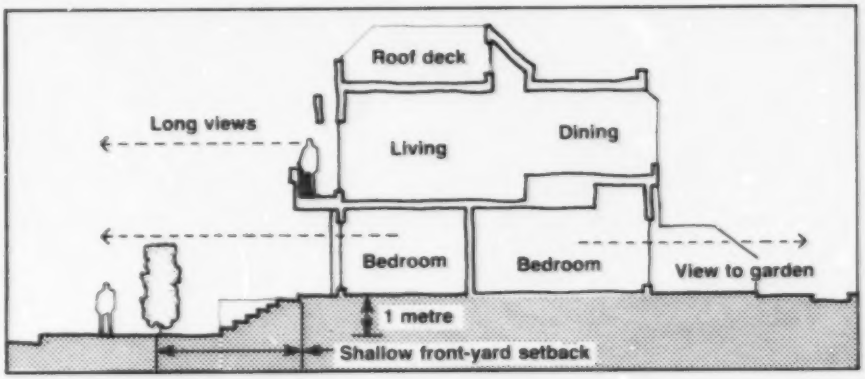
Design Solutions

Privacy can be provided in shallow front setbacks by, for example, placing the ground floor level of a unit one metre or more above grade, and locating main living areas on upper floors (figure 121).

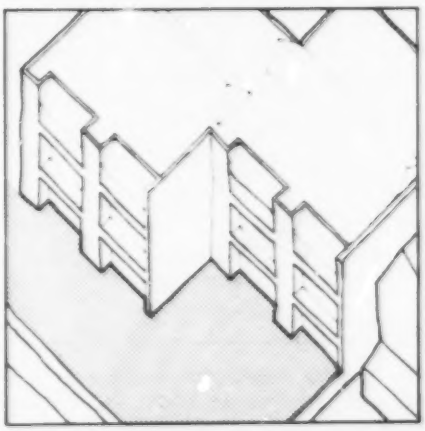
Where the front setbacks of adjacent units differ, the exposed side wall of the outermost building should be treated to reflect its greater visual exposure in the streetscape (figures 122 and 123).



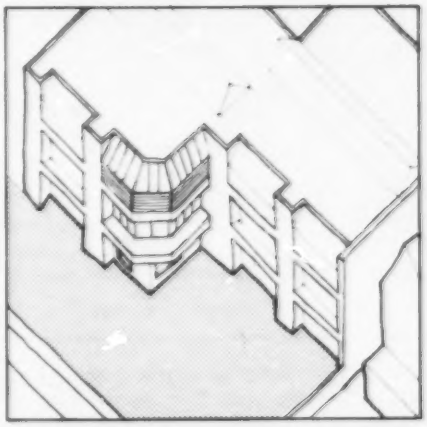
120. The setback of new units should be an average of those for adjacent houses.



121. Level changes can greatly improve privacy inside the new dwelling.



122. Blank walls do not improve the appearance of dwelling or street.



123. Wrapping the building façade around a corner can be a solution to the blank-wall problem.

124. Small details are important to the liveability and appearance of a housing project. The fanlight, divided steps and lower-entry roofs all enhance this Toronto project's entrance.

The principles outlined in the following pages deal with provision of a suitable environment in and around the individual dwelling. An analogy can be made with clothing, which serves a number of functional needs — warmth, protection and support — as well as providing opportunities for decoration, expression and identification for the body. The dwelling, in addition to providing shelter, also provides opportunities for identity and self-expression, which are important in urban settings. A good example of this is shown in figure 124.

Private Outdoor Living Area

The site of an infill project is generally constricted, and the outdoor living area is therefore small. Even some of the minimum requirements for usability may be difficult to achieve at or near ground level, and solutions may have to be sought in upper level spaces such as terraces and balconies.

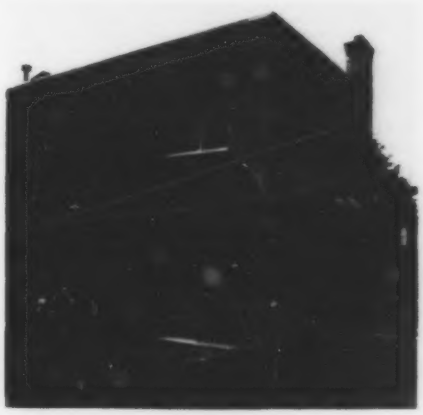
The larger the outdoor living area, the more flexible and usable it will be. A single, generously scaled space is therefore the ideal. However under certain site constraints two smaller areas may be necessary, one related to the living areas of the unit, and another, more private, related to the sleeping areas. The desire to provide outdoor space often results in space that is unsuitable for its intended purposes, and consequently, it is not used. Figures 125 to 128 show conditions to be avoided.

Principles

The outdoor living area should be directly accessible from the dwelling. The following qualities are especially important.

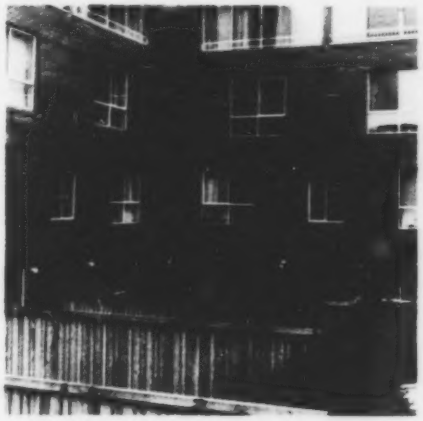
Size
The area should be able to accommodate outdoor activities and the number of people expected to use them. A minimum depth of 5 metres is suggested for an outdoor living area at grade.

Location
Ground level location on a well-drained site is preferred. Below grade outdoor living areas should be avoided. Upper level outdoor living areas with a minimum depth of 2 metres are acceptable.



125. This "private" terrace adjacent to walkway is inadequately screened.

126. Avoid conditions like this sunken outdoor living area.

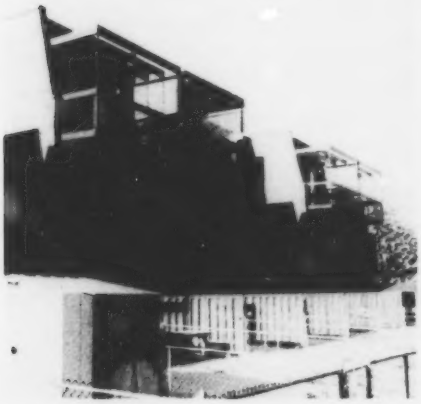


127. Private outdoor areas should not be directly overlooked by adjacent dwellings.

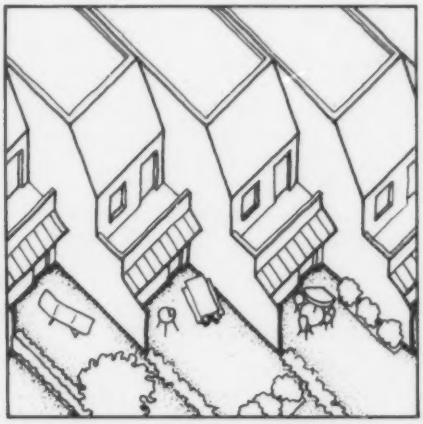
128. This balcony near grade level lacks privacy, creates useless space underneath and restricts daylight to the basement window.

129. Extensive landscaping can screen front-yard outdoor space.

130. Private outdoor space can be provided on a roof terrace.



131. In areas difficult to screen from public view, the outdoor living area can be placed above grade.



132. Rows of units can be staggered to improve privacy between adjacent outdoor living areas.

Orientation
Outdoor living spaces should be oriented towards the sun and long-range views.

Adaptability to climate
Outdoor areas should have protection from the sun, partial enclosures, wind and rain shelters, plants, screens, and other personal fittings.

Visual privacy
Protection from overlook, particularly from driveways and walkways, should be ensured (figure 129).

Acoustic privacy
Outdoor areas should be protected from noise from the street and neighbours.

Safety
Adequate barriers should be provided to discourage climbing by children.

Materials
A hard surface adjacent to the dwelling unit should be provided.

Design Solutions

Upper level terraces and roof decks can provide a private outdoor living area when ground level area is restricted or lacks privacy (figures 130 and 131).

Layering of functions will allow private outdoor decks over parking.

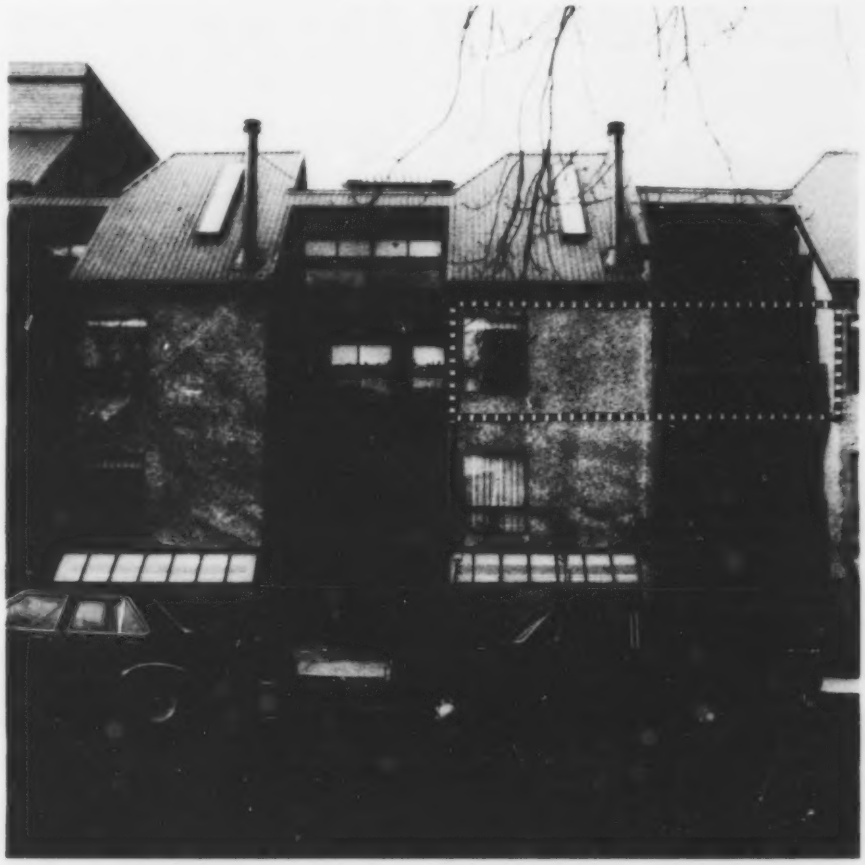
Staggering the building in plan or section can assist in providing sun, views, privacy, and so on, for the outdoor living area (figure 132).

Unit Identity

Unit identity comprises the individual dwelling and its immediate "territory" under the control of its occupants. The ease with which residents can identify with a particular unit within an infill project is a key factor in dwelling amenity. An important difference between conventional forms of housing, such as walk-up apartments and recent infill housing at the same density, is the emphasis given to unit identity in new projects. In several cases, even though the project has been classified as a single apartment building for zoning and construction purposes, the design of the building form suggests individual townhouses.

Individual unit identity is particularly important in marketing condominium tenure projects, as many buyers perceive these as more of an individual than a collective form of ownership. The infill designer and developer must balance the need for unit identity with the need for a consistent and unified character for the entire complex (see Project Identity). Even though rental and cooperative projects may put less emphasis on unit identity, it still fulfils an important need of residents for self-expression within a collective setting, and results in more easily marketed housing.

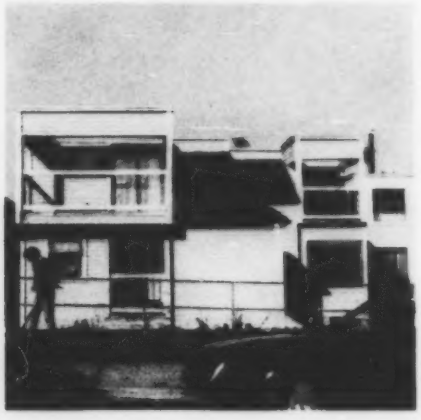
In higher density projects with units stacked above each other (as in walk-up apartments), unit identity may be more difficult to achieve because contact with grade level, and therefore control of the territory around the unit, may be lost.



133. This walk-up apartment building in Vancouver has a distinctive façade that suggests a unit identity that does not correspond to the actual layout of the building.

134. In these semi-detached units, each unit plan is different and entries to units are off different streets.

135. Individual units are articulated here by staggering them in the building plan.



136. The staggered façade and roof forms used in this Vancouver project identify individual units.

Principle

Each unit and its immediate territory within an infill project should be differentiated from its neighbours to an extent consistent with other objectives, such as project identity and neighbourhood compatibility.

Design Solutions

A distinctive identity can be created by using architectural elements to distinguish neighbouring units in plan, elevation, or detail (figures 133 and 134); and by using site landscaping elements to define unit territories:

- use dormers, bay windows, rainwater leaders, façade variations, and so on, to differentiate between similar units
- stagger units in plan or elevation when conditions permit (figure 135)
- when units are stacked vertically, recess or project the upper units, and use different materials to distinguish them
- create individual roof forms for each dwelling (figure 136).

Unit Entry

The unit entry provides the transition between the private realm of the dwelling unit and the public spaces of the project and street. In the unit entry occupants meet visitors and socialize with each other.

The preferred location for the entry is at or near grade because it establishes a direct relationship between the dwelling and the street, and enables an "entry zone" under the control of the occupant to be defined adjacent to the unit. Site constraints, however, may make this difficult to achieve. Entries above grade often lack exposure, although the traditional curving staircase of Montreal triplexes make the connection between upper levels and the sidewalk visible and direct (figure 137). Entries to units by means of building lobbies and internal stairs and corridors (common to walk-up apartments) are less acceptable because they are anonymous and establish an additional zone separating the unit from the public area. They may also be subject to security problems.

The traditional and preferred entry for infill housing is direct access from the street. Again, this is not always feasible in certain types of infill sites. Careful design to improve the identification and visibility of off-street units will be required. Figures 138 and 139 show conditions that should be avoided.

137. Exterior staircases to second-floor entries are typical of the pre-war housing stock in central Montreal.

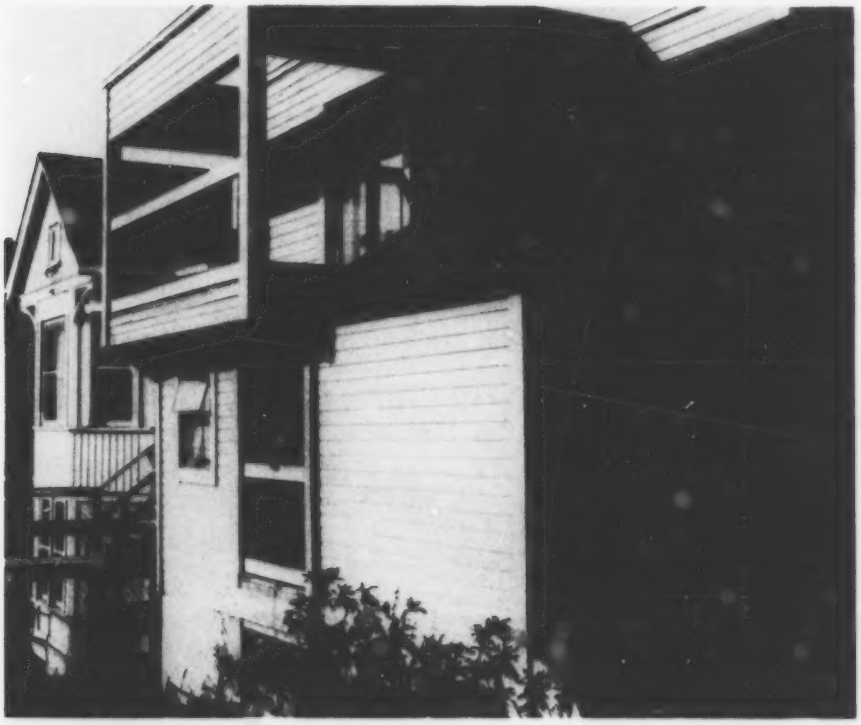
138. Sunken entries should be avoided.

139. The "ownership" of this space is ambiguous because the upper and lower units in this stacked townhouse share the same porch.

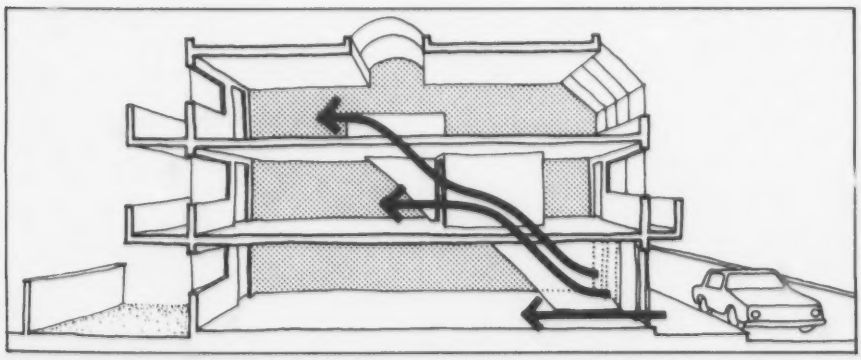
Principles

Several criteria are important in the design of unit entries:

Visibility
Unit entries should be able to be seen from a location near the project entrance.



140. A unit entry need not be elaborate to be successful. This entry in a Vancouver unit is visible yet private, defined and protected.



141. Grade level entries for units stacked above each other are possible if interior stairways are used.

Definition
Entries should have sufficient separation space from the street, sidewalk or communal space to have an entry transition zone. The zone should be clearly marked as semi-private territory under the control of the occupant.

Privacy and public space
Although the entry is the place where occupants meet visitors, it should also have a measure of privacy from neighbours.

Personalization
Entries should be capable of being decorated or personalized by the occupants.

Protection
Functional considerations such as lighting at the door, door address number, steps, sufficient area to receive visitors and protection from rain, snow and wind must all be satisfied.

Socialization
Opportunities for interaction among residents by the provision of porches or seating areas in conjunction with the entry should be considered.

Design Solutions

Entry walkways may be partly shared with neighbouring units, but should be separated at an appropriate point (by porches, stoops, or changes in level) to avoid confusion or ambiguity.

Entries perpendicular to the sidewalk or public walkway system may not be easily seen by visitors and may need canopies or other devices to make their function visible (figure 140).

Internal stairs within upper-level dwelling units can be used to bring unit entries down to grade level (figure 141).

Unit Layout

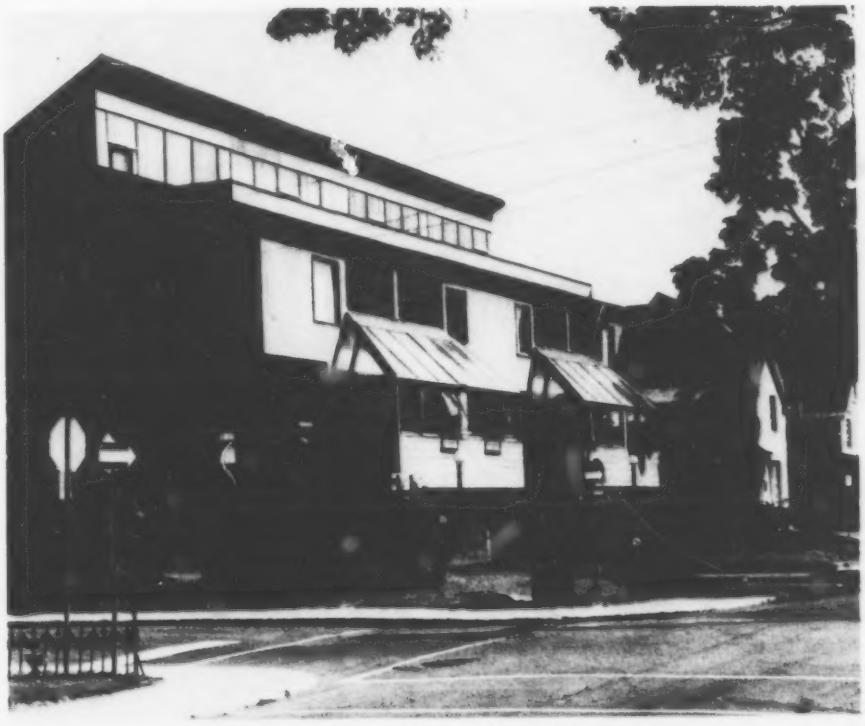
The layout of rooms within the unit relative to open areas of the site has important implications for energy conservation, daylight and solar access, and acoustic privacy. Infill site conditions often result in long units with narrow frontages. Unit orientations are usually fixed by lot boundaries, as well as by the context of neighbouring buildings, trees, and streets whose shadows and noise may impinge on the site. Figure 142 shows a project well-located for passive solar heat.

Energy conservation
Attached forms of housing, common in infill projects, can be relatively energy efficient because they have a lower ratio of exposed wall to floor area than other forms of housing. North window orientations are not recommended but may have to be accepted in an urban setting.

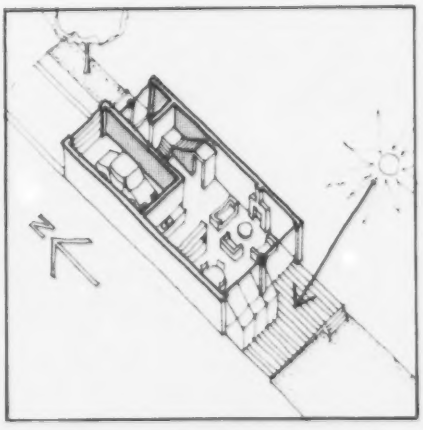
Sunlight/solar access
Access to sunlight is essential for habitable rooms and the operation of passive and active solar heating systems. This may be difficult to achieve in long narrow unit plans with limited orientations. Nearby buildings and trees may also block sunlight to the project.

The preferred south orientation for the principal windows of a dwelling may conflict with other aspects such as orientation towards views, access to private open space, and privacy from nearby dwellings.

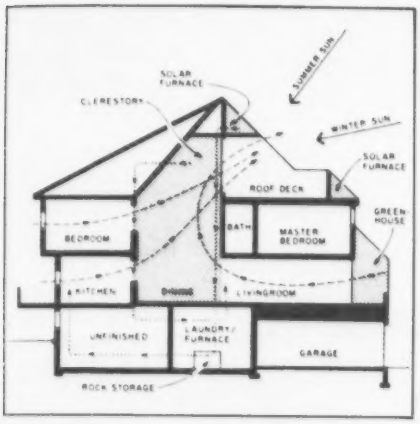
Acoustic privacy
Noise from road traffic, railways, and nearby land uses may be an unavoidable aspect of many urban housing sites. Noise from on-site sources such as adjacent units or outdoor spaces is more easily controlled.



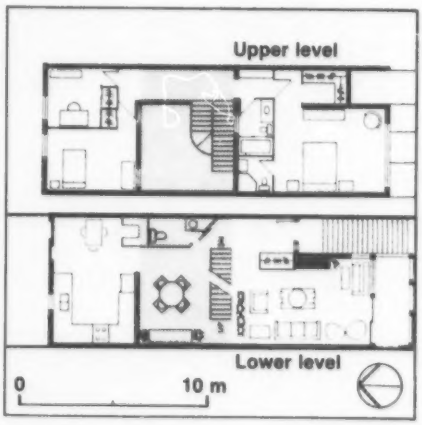
142. Passive solar infill houses in Ottawa are on the north side of an east-west street.



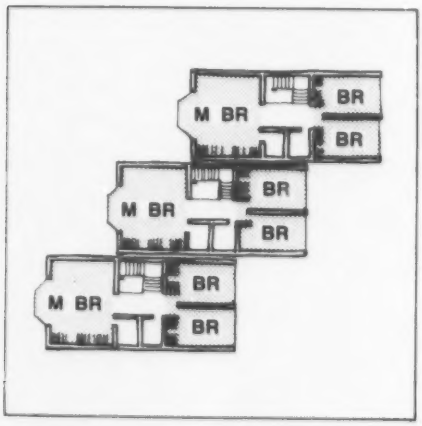
143. Service areas located on the north side of a dwelling and living areas on the south aid energy conservation.



144, 145. The atrium and south-facing roofs and windows maximize passive solar gain.



145.



146. Double-wall construction and staggering units aid acoustic privacy.

Principles

Energy conservation
Unit layout should reduce as much as possible the amount of exposed wall area and the area of north-facing windows.

Sunlight/solar access
Habitable rooms should receive sunlight throughout the day if possible. Unit orientation and window placement should make the best use of winter heat gains but guard against summer heat gains.

Acoustic privacy
Units should be protected against external noise sources. On-site noise sources should be isolated or controlled.

Design Solutions

Energy conservation
Place service spaces such as garages and storage areas to the north side of the dwelling, living areas to the south (figure 143).

Take advantage of attached housing forms, which minimize the amount of wall area subject to heat loss; and compact, two-storey housing forms, which also reduce exposed wall areas.

Sunlight/solar access
An atrium can be used to admit daylight and sunlight into the internal spaces of the dwelling (figure 144).

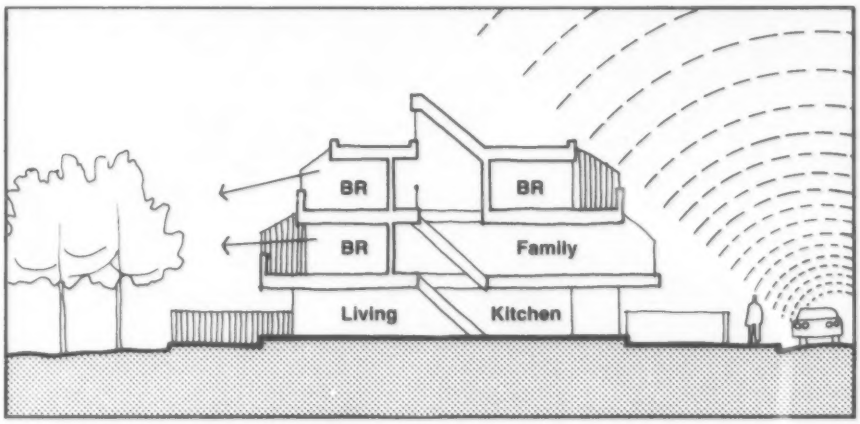
Appropriate south-facing window orientations and roof angles can be used for passive and active solar heat design (figure 145).

Acoustic privacy
Stagger attached units to minimize the length of communal wall (figure 146).

Use construction methods such as double stud party walls to minimize noise transmission between dwellings.

Orient quiet areas of the unit (for example, bedrooms) towards quiet areas of the site (figure 147).

Set back upper floors to reduce the impact of street noise.



147. Upper floors can be set back and quiet areas oriented away from the street to achieve acoustic privacy.

List of Project Credits

Figures 1, 96, 136, 140
Keefer Street Co-Op Housing
Vancouver
Architect: Bruno Freschi

Figure 4
Balmy Avenue Townhouses
Toronto
Architect: Tsow and Pollard

Figures 5, 42, 52, 67, 101, 113
Willow Arbour
Vancouver
Architect: James Cheng

Figures 6, 32, 131
Owl House Lane
Toronto
Architect: Peter Turner

Figures 15, 37
Riverdale Avenue houses
Toronto
Architect: Noel Hancock/David Simpson

Figures 18, 64
Rosedale/Echo
Ottawa
Architect: W. Mohaupt

Figures 22, 66
Percy Street School
Ottawa
Architect: W. Mohaupt

Figures 24,
Trinity Mews
Toronto
Architect: Harvey Cowan

Figure 28
2774 West 1 Avenue
Vancouver
Architect: Sankey Partnership

Figure 43
Alvin Avenue infill proposal
Toronto
Architect: Irving Grossman

Figure 47
Strathcona infill
Vancouver
Architect: Thompson, Berwick and Pratt

Figure 48
Trefann Court
Toronto
Architect: Sillaste and Nakashima

Figures 49, 124
Campbell-Antler
Toronto
Architect: Matsui, Baer and Vanstone

Figures 129, 134
Vancouver
Architect: Peter Wardle

Figure 53
Hydro Block
Toronto
Architect: Diamond and Myers (A.J. Diamond, partner-in-charge)

Figures 56, 61, 98, 130
EERA townhouses
Vancouver
Architect: Hawthorn, Mansfield, Towers

Figure 62
Dufferin-Gwynne
Toronto
Architect: Brook, Carruthers, Shaw

Figure 63
Belvedere Court
Ottawa
Architect: Ian Johns

Figure 65
Brown's Inlet
Ottawa
Architect: W. Mohaupt

Figures 84,
Laurel Court
Vancouver
Architect: Rhone and Iredale

Figure 104
Queen Street East
Toronto
Architect: Noel Hancock/David Simpson

Figures 142, 144, 145
Chapel and Charlotte Streets Solar townhouses
Ottawa
Architect/Builders: Ecodomus Ltd.

Photo Credits

M.C. Chabanne
Figure 59

James Cheng
Figures 5, 42, 52, 67, 101, 113

Irving Grossman
Figure 43

Hawthorn, Mansfield and Towers, Vancouver
Figures 56, 98, 130

R. Hill
Figures 4, 6, 15, 16, 24, 26, 32, 37, 44, 46, 48, 49, 50, 62, 84, 88, 92, 104, 114, 124, 125, 126, 128, 131, 133, 135, 137, 138, 139

T. Martin
Figures 1, 7, 25, 45, 51, 53, 61, 63, 87, 96, 103, 112, 115, 127, 129, 134, 136, 140

Ian Samson
Figure 3

Sankey Partnership, Architects
Figure 28

Canada Mortgage and Housing Corporation
Figures 18, 22, 41, 47, 65, 66, 142

CMHC Advisory Publications

Housing Disabled Persons
NHA 5467

An advisory document giving design criteria for accommodation being built for the handicapped. Illustrated. 60 pages.

Outdoor Living Areas – Advisory Document
NHA 5329

Discusses planning and design considerations and presents case studies. Illustrated. 57 pages.

Parking Areas – Advisory Document
NHA 5239

Explores ways of stimulating functional and satisfying solutions to the problems of providing parking areas. Illustrated. 66 pages.

Play Opportunities for School-Age Children, 6-14 Years of Age – Advisory Document
NHA 5318

Appropriate design, location and site landscape suggestions to reduce conflicts between school-age children's play, and activities of other age-groups in medium and high-density residential developments. Illustrated. 102 pages.

Play Spaces for Preschoolers – Advisory Document
NHA 5138

Gives guidelines for planning the siting, design and operation of play spaces for young children in a residential area. Illustrated. 45 pages.

Residential Site Development – Advisory Document
NHA 5364

Contains a wide range of information concerning the planning and development of residential subdivisions. Included are descriptions of eight Canadian subdivisions which incorporate innovative and cost-saving features. Illustrated. 165 pages.

CMHC making
Canada a better
place to live